

The Emergency Patrol

POPULAR MECHANICS

MAGAZINE

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PAGE 1

BUILDING
the
"LIBERTY"
FLEET





A true experience of
R. S. McILWRAITH,
Libby, Montana



**"THE SAVAGE BEAST
HAD ME CORNERED!"**



1 "A TERRIFIC CRASH startled me right out of bed one night as I slept in the cook house of the mining camp where I work," writes Mr. McIlwraith. "Half awake, I rushed into the kitchen to investigate—and found a huge bear had broken in and was tearing into our food supplies."



2 "MADDENED by my interruption and savage from hunger, the great creature started for me. My only thought was to get away from him—and fast—as these big cinnamonos can be bad medicine in close quarters. I darted back into my room. Then to my horror I realized that the bedroom windows were too small for me to get through."



3 "IN A NIGHTMARE of panic, I broke out in a cold sweat. Then I remembered my flashlight. Desperately, I grabbed it from a shelf, whirled and flashed it full in the bear's face. He stopped short. Baffled growls came from his dripping jaws . . . and he turned and lumbered out of the shack. It's my hunch that I was one step from being mincemeat when I picked up that 'Eveready' flashlight with its dependable fresh DATED batteries."

(Signed) *R. S. McIlwraith*



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of Taper Cuts; Grinding Angles for Wood Turning.

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"The Marines have Landed"

and
**CRESCENT
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OFFICIAL MARINE CORPS PHOTOS.—Down the cargo net, (above) from the deck of a Navy transport, go America's pride—our United States Marines. Shortly after this picture was taken, "the situation was well in hand."

The Marines establish a beach-head, (left) This toughest of all fighting jobs has been a specialty of the U. S. Marine Corps since they first landed at the Bahamas in 1776.



Popular Mechanics Magazine

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H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

March, 1942

Vol. 77, No. 3

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What to Do in a Blackout

WHEN the sirens howl and the yellow light of the "alert" in army interceptor headquarters changes to the blue light of the blackout, the important thing is not to become excited. There are certain steps you should take, before and during the blackout. They are outlined for you in a timely article next month, which also gives you a glimpse of California in the dark. Before the emergency, store some water in sterile containers, and lay in candles and flashlight batteries. Plan a "darkroom"—lighted inside, dark from outside. Read this article for helpful advice.

Call to Battle Stations

UNCLE SAM'S mighty fleet goes into action. From the deck of an airplane carrier, fighter, scout, bomber and torpedo planes roar into the sky. Destroyers screen the battle line, submarines stalk enemy transports, battleships lash out with salvos of 16-inch shells. In the April Coloroto section you'll see the Navy in action—eight pages in color.

Next Month

RAISING a small, club-shaped .22-caliber rifle to his shoulder, a marksman took careless aim at an armor-steel target and fired. The bullet went clear through the slab of steel. Any ordinary "22" would hardly knock down game bigger than a rabbit. This high-velocity "super-22" will kill any big game by hydrostatic shock, even if it strikes a leg. The powder charge is terrific; the tiny bullet liquefies and literally flies into dust when it hits. Read about this sensational new weapon in the April issue.

10,000,000 "Hellos"

BIGGEST potential traffic tangle in the world is in New York's telephone system. But it never snarls. Daily calls are flirting with the ten-million mark. At the peak, 300 to 400 numbers are dialed every second. A feature next month tells of the technical magic that controls this gigantic traffic flow: a new "electrical brain" that connects your call, pulp-insulated wires so slender that 4,242 fit in a cable no bigger than your wrist.

Outwitting Saboteurs

DURING the last war, saboteurs started fires with "pancakes" of burlap soaked in self-igniting chemicals. Now they're dropping glass marbles that catch the sun's rays in their universal focus, and lead cigars whose hidden chemicals are a "delayed fuse" for a destructive blaze. But there are ways to outwit the saboteur. Read the April story and be alert.

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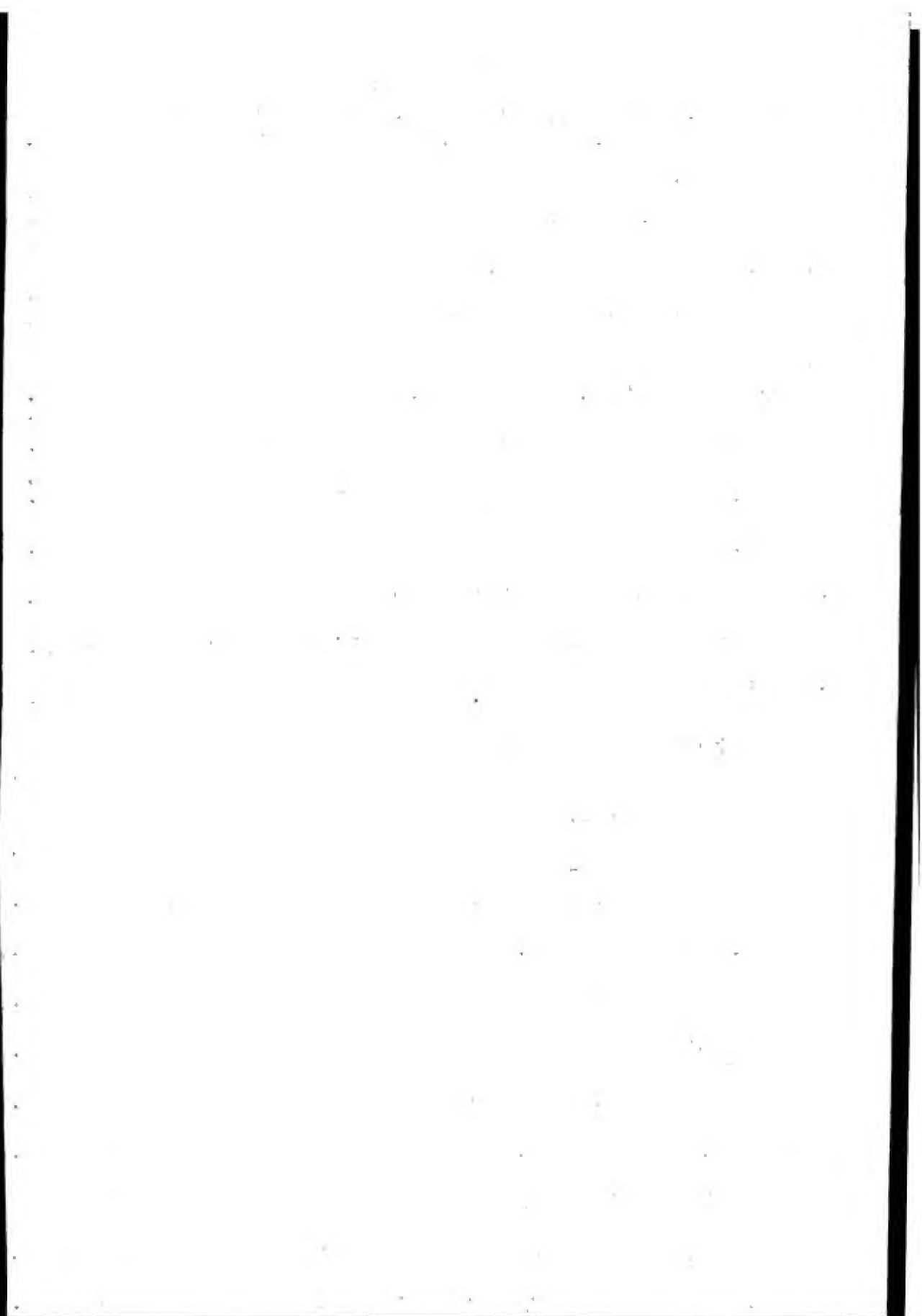
MARCH 1942

AIRPLANE

Fighter, cockpit (Hurricane, Messerschmidt)	71 Mar.
Landing lights, portable, invisible overhead	39 Mar.
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Tomorrow's takes shape	56 Mar.
Windshield, twin, for air liner	90 Mar.
Wings, flying	14 Mar.
Album, reflected light, for viewing color slides	12 Mar.
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AUTO

License plates, long term, save steel	80 Mar.
Baby carriage mirror keeps infant amused	90 Mar.
Black light guides army trucks at night	81 Mar.
Blocks, hollow wooden for wall building	13 Mar.
Bomber, supercharger rotor tests	49 Mar.
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Camel's hump stores fat, not water	198 Mar.
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Can this happen to YOU?

It was the President talking—telling George that while he would like to give him the job—to promote him to an executive position, it was impossible to do so.

This was a bitter blow to George—he had known for some time there would be a vacancy in his department—the department manager was moving up—a new department head would be appointed. By seniority George was entitled to the job, had been counting on it.

It would mean more money—those unpaid bills would be taken care of—the children would have more advantages—there would be travel, recreation, social activities.

George had been a fine, loyal employee for twelve years—doing his assigned tasks well—hoping by faithful service to win some day an executive position with his company.

Now all of these hopes were being swept away—as in a dream he heard his chief continue—“You see, George, in these days it is ability to produce that counts. You’re not ready to take on the bigger job—you have made no preparations which would enable you to fill it properly. The man who is going to get that job is Martin. He has been with us only four years, but during that time he has not only been studying the relationship of his department to

the business as a whole, but he has been studying and preparing himself at home.”

Poor George—no one to blame but himself. Business is full of “Georges”—men who do not realize the importance of preparing definitely for promotion. They forget that long experience on one job does not necessarily prepare them for the job above. And almost never do they reach the executive job and the bigger money.

Fortunately, there is a way—simple, practical, thoroughly proved by thousands—for the “Georges” to make sure of promotion. Modern home study—the LaSalle way—gives them rather quickly the knowledge and ability to handle the job ahead. It does not interfere with their present job—instead it helps. It is moderate in cost and intensely interesting.

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If you are one of the men in business doing routine work—going along in a low pay job, there is one thing, in fairness to yourself, you should do right away—and that is—**FILL IN AND MAIL THE COUPON BELOW AT ONCE.** It can be the turning point in your business career toward the bigger rewards business is willing to pay to the man who is trained. Our FREE booklet “TEN YEARS PROMOTION IN ONE” is most inspiring. Don’t let a postage stamp and one minute stand between you and full details regarding our training and opportunities to which such training leads.

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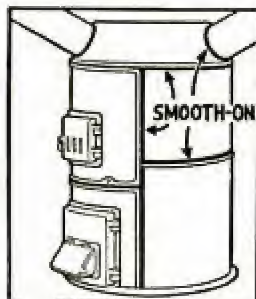
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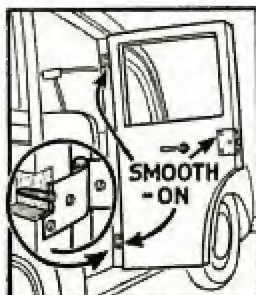


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Mountain Pen 1947
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POPULAR MECHANICS

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Cutouts from plastic for easy sawing	12 Mar.
Darkroom, throwing light on	92 Mar.
Dog carries card in tube on collar	60 Mar.
Dog, rolling sling permits spine to heal	54 Mar.
Door arch easy to shape with flexible bead	59 Mar.
Drawing board, adjustable glass lighted from beneath	76 Mar.
Ear, right, does not hear pitch left ear hears	80 Mar.
Engine, tiny 18-cylinder spins 5-foot propeller	49 Mar.
Eyes, glass, give man super vision	72 Mar.
Fireboat rides trailer ashore	48 Mar.
Flower tray	22a Mar.
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Fluorescent lamps depict bomber in pageant	55 Mar.
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Fruit ripeness told by color photos	38 Mar.
Furnace draft gauge checks flue and chamber	86 Mar.
Gas works model tests plans	45 Mar.
Gasoline, odors removed by low cost process	48 Mar.
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| <input type="checkbox"/> Aviation <input type="checkbox"/> Aviation Mechanic | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Structural Engineering |
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| <input type="checkbox"/> Chemistry | <input type="checkbox"/> Industrial Metallurgy | <input type="checkbox"/> Radio Operating | <input type="checkbox"/> Telephone Work |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Radio Servicing | <input type="checkbox"/> Textile Designing |
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- | | | | |
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| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Commercial | <input type="checkbox"/> Foremanship <input type="checkbox"/> French | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Commercial Illustrating | <input type="checkbox"/> Good English | <input type="checkbox"/> Secretarial <input type="checkbox"/> Spanish |
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| <input type="checkbox"/> Cartooning <input type="checkbox"/> Civil Service | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Traffic Management |

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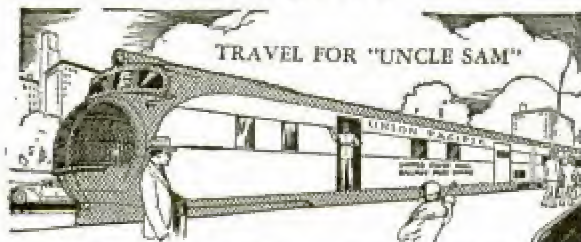
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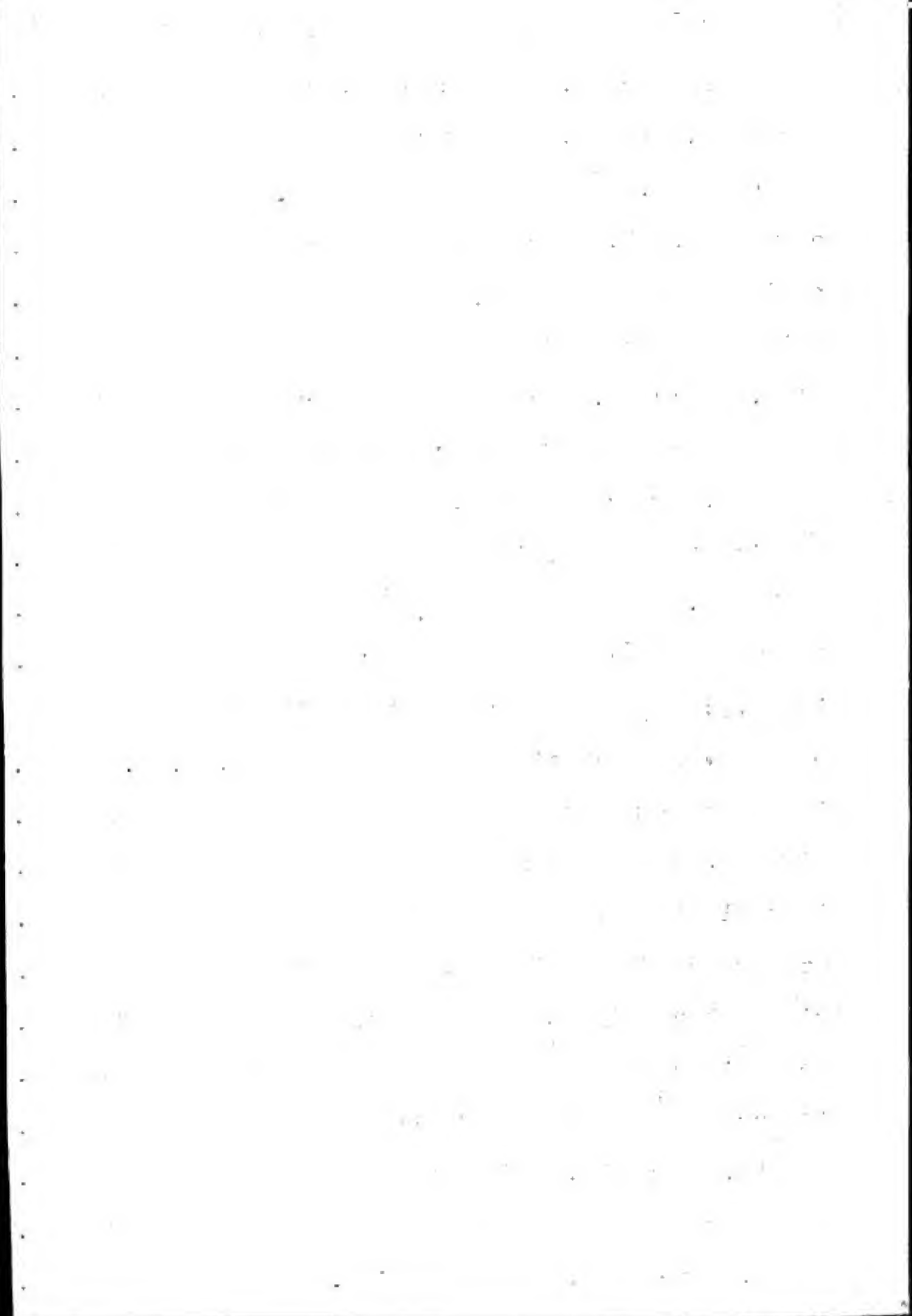
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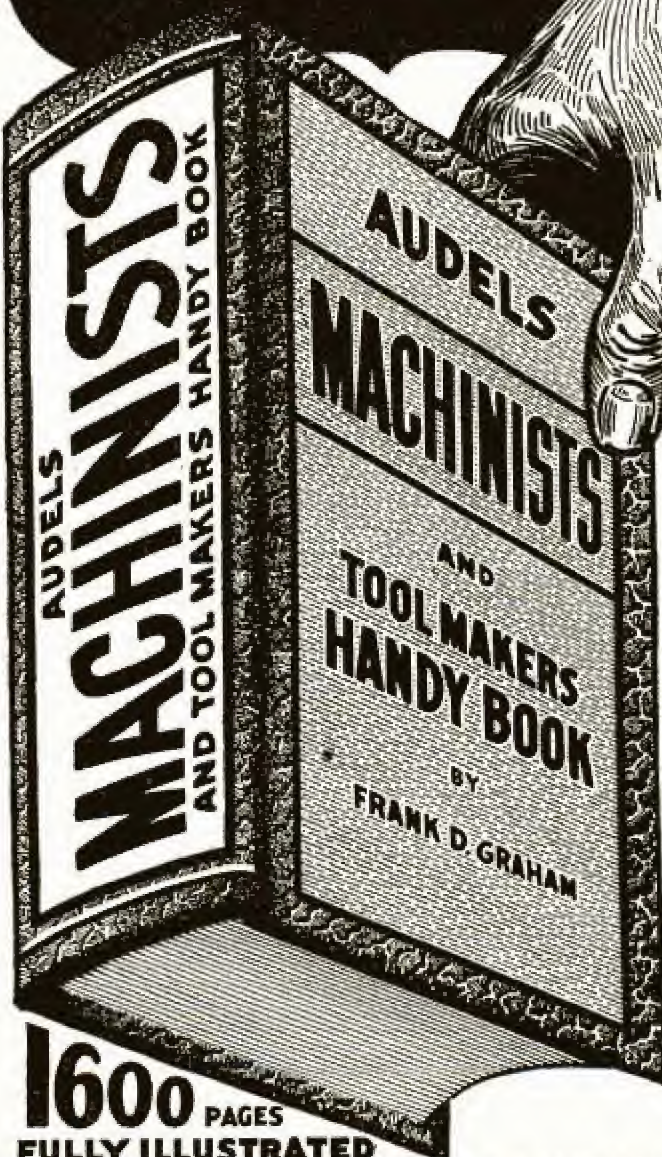
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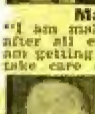
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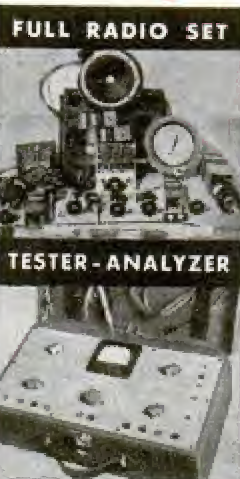
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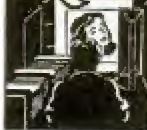
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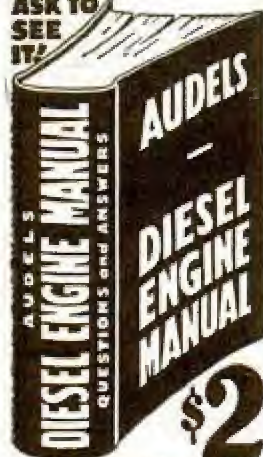
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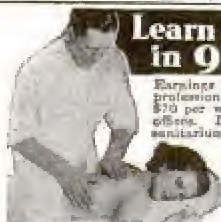
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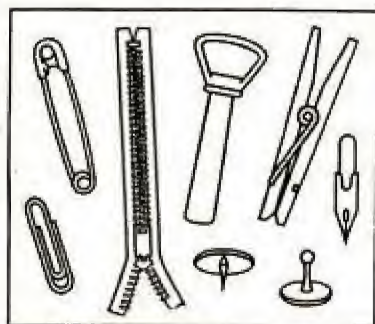
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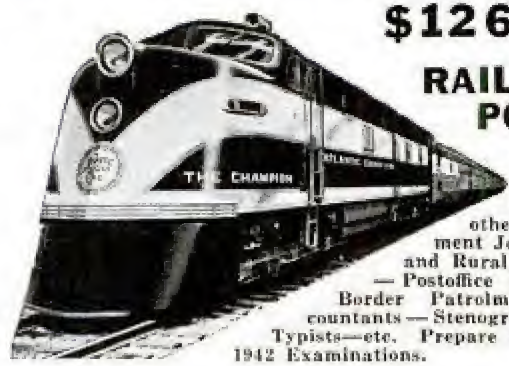
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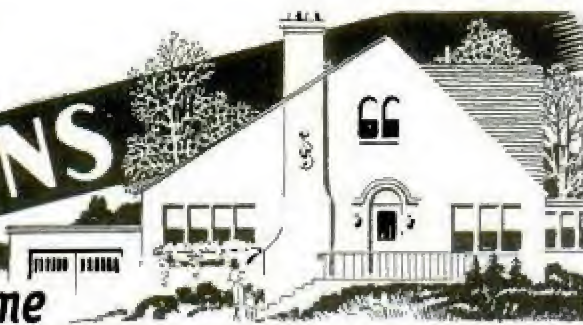
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For Your Home

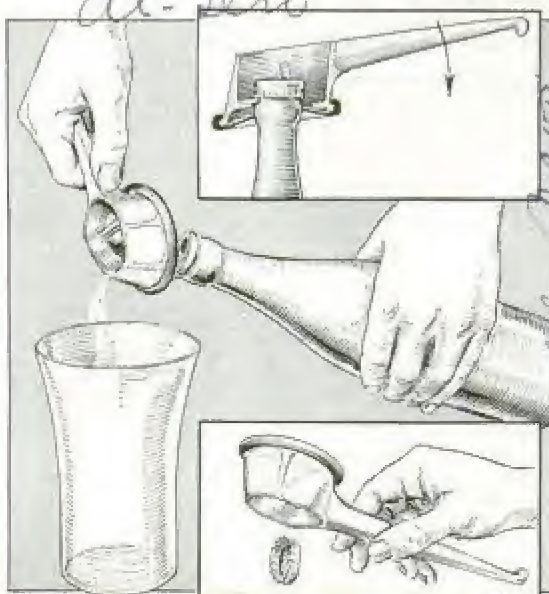


Humidor Suspended in Fruit Jar Prevents Drying of Food



Primarily intended for storing popcorn, but useful also in preserving other foods or smoking tobacco, a humidifier fitting the neck of standard fruit jars keeps the contents from drying out. For best corn-popping results, there should be some moisture within the kernel, and keeping the top of the humidifier damp will maintain the proper humidity within the jar.

Retaining Cup on Bottle Opener Prevents Squirting of Liquid



With a bowl-shaped retainer and a flexible rubber shield that seals itself about the bottle neck, an opener for carbonated beverage bottles prevents the contents from squirting and holds any liquid that may fizz over. In opening a bottle the rubber shield slides past the cap, and the opener is operated like any other, except that the cap need not be removed completely if beverage effervesces violently.

(More Popular Inventions on page 24A)

Tray for Short-Stemmed Flowers Holds Them Upright in Grill

Equipped specially to accommodate fresh flowers with short stems, a tray serves as a centerpiece without obstructing the view across the table. The tray is covered with a white enameled grill through which the stems are placed so the ends remain submerged in water.



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POPULAR INVENTIONS

For Your Home

21366 (Continued from page 22A)

Coiled Taper in Candleholder Is Unwound as It Burns

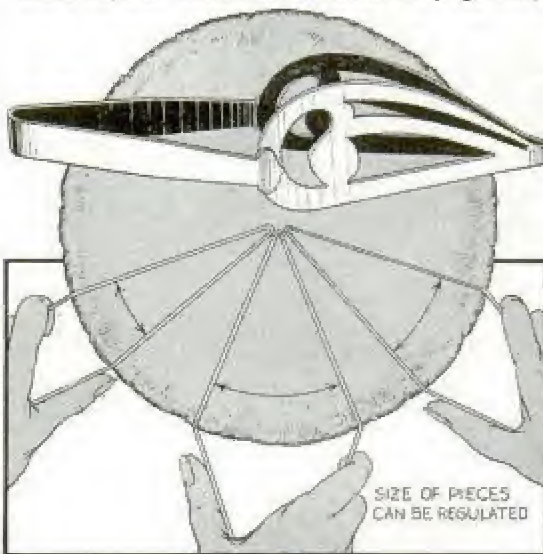


Storing a yard-long taper coiled about a metal pin, a candleholder supplies many hours of light. As the tallow burns away, the taper may be fed upward by turning a crank.

Cake Knife With V-Shaped Blade Lifts the Piece It Cuts

Bent in the form of a "V," the blade of a new cake knife cuts a wedge from a cake in one stroke, and then by squeezing the tonglike handle you can pick up the piece intact. Slices can be cut smaller by applying pressure on the handle.

(More Popular Inventions and Index on page 46A)



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INVENTORS

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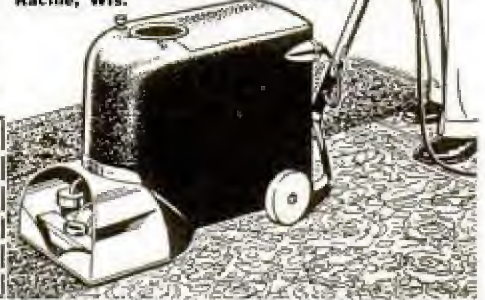
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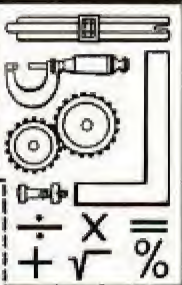
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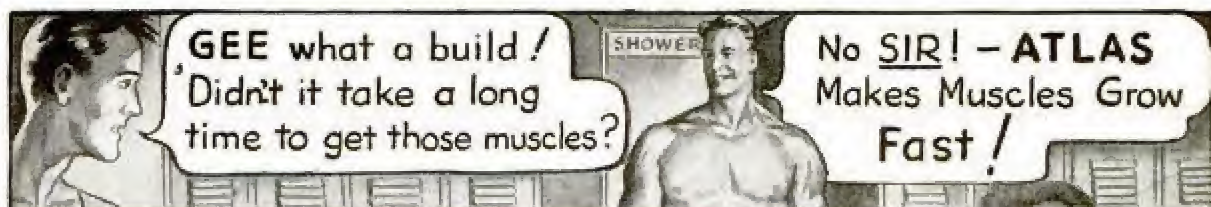
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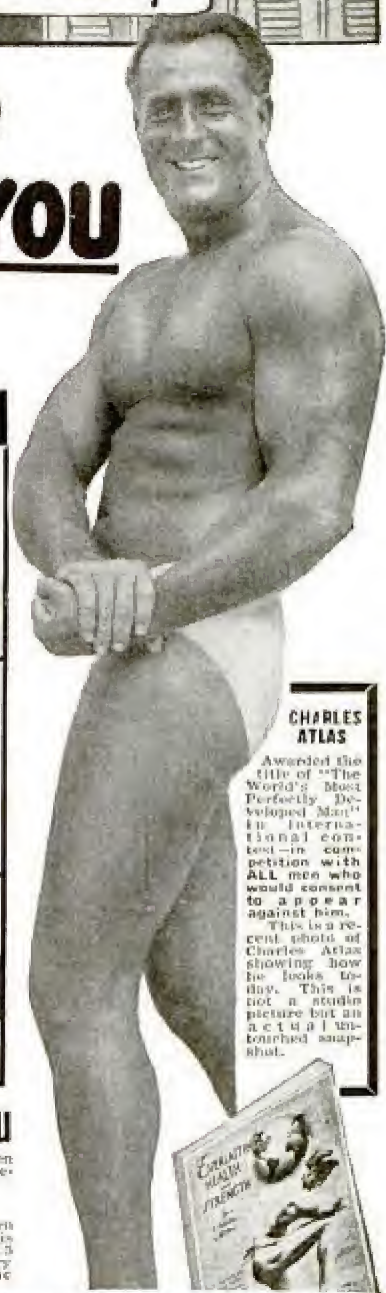
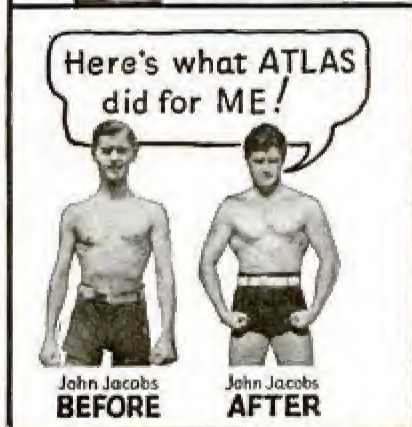
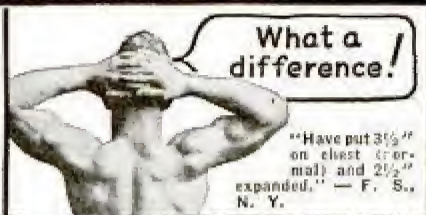
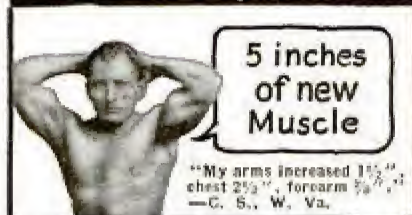
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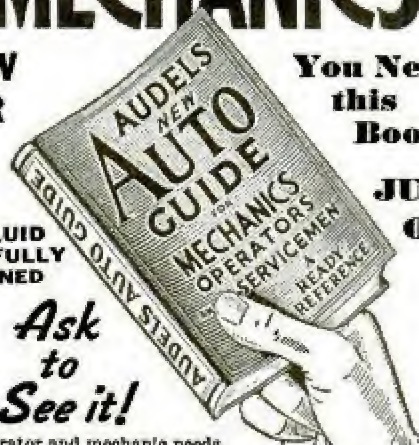
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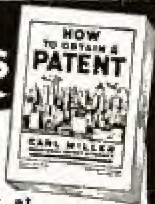
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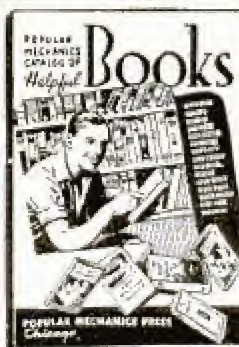


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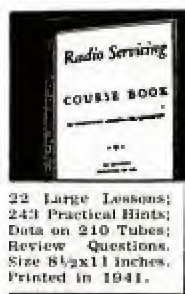
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TRICKS You can do. Free catalogue. Magicraft, Harrisburg Station, Houston, Texas.

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I WILL Pay \$100.00 each for 1924 1c green Franklin stamps, rotary perforated eleven (up to \$1,000.00 each unused). Send 6c today for large illustrated folder showing amazing prices paid. Vernon Baker, (23-PM), Elyria, Ohio.

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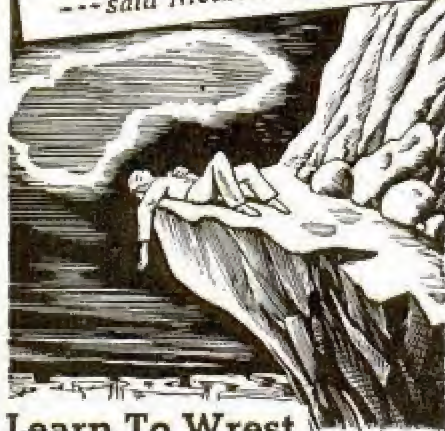
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21365 (Continued from page 24A)

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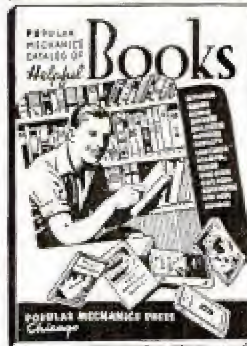
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"What can I do?

"I've looked in my shaving mirror for an answer—and found none.

"I've seen only the perplexed face of a middle-aged man—a man too old to bear arms.

"I've glanced at my hands, too,

a thousand times, only to learn a brutal truth.

"They are soft and white—strangers to the production line where only skilled hands are wanted now."

"What can I do?

"Only last night I found the answer as my eyes fell on my wife's knitting bag and my ears caught the click of her knitting needles.

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Vol. 77

MARCH, 1942

No. 3

21336



FUTURE SOURCES of POWER

Dr. Charles G. Abbot of Smithsonian Institution standing beside flash boiler—a solar power plant. In foreground is toy cooker in which tiny cakes can be baked. Mirrors concentrate sun's rays

By Prof. C. C. Furnas

School of Engineering, Yale University

RAYS of the sun shower as much energy on the earth's surface in one minute as the entire human race utilizes in one year. Despite the presence of this bountiful and unusual flow of energy, a large part of the struggles of the human race are concerned with acquiring and controlling

sources of power. Evidently our state of development in the utilization of power is still rather crude.

Suppose our oil and coal supplies were to become exhausted; we know that water power never would be sufficient for our needs; we know, too, that wind, tides, waves and other sources of power would be inadequate—so, what chance have we of getting our power from the sun?

21336

Mr. Phillips Thomas

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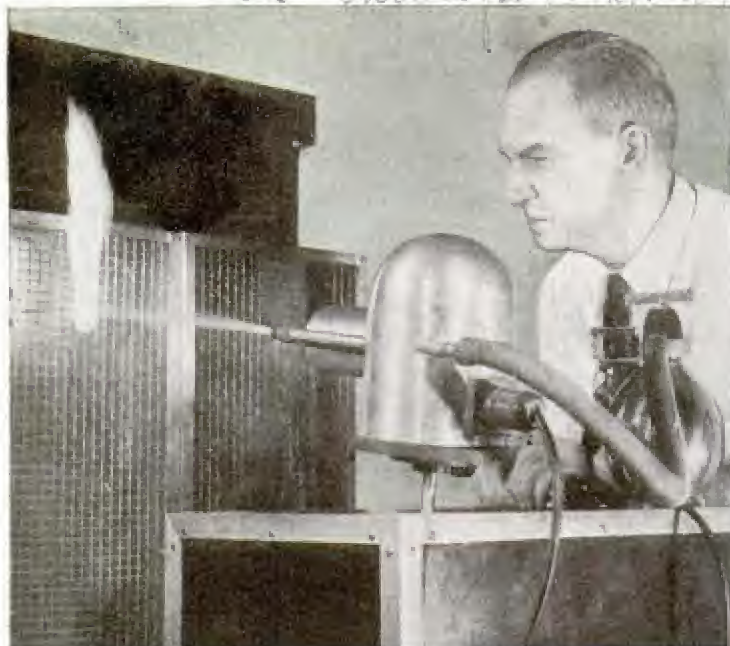


Photo-tube like one which causes this robot to move across wire screen until it "sees" fire, then squirts water at flame, might be key to utilization of sun's energy

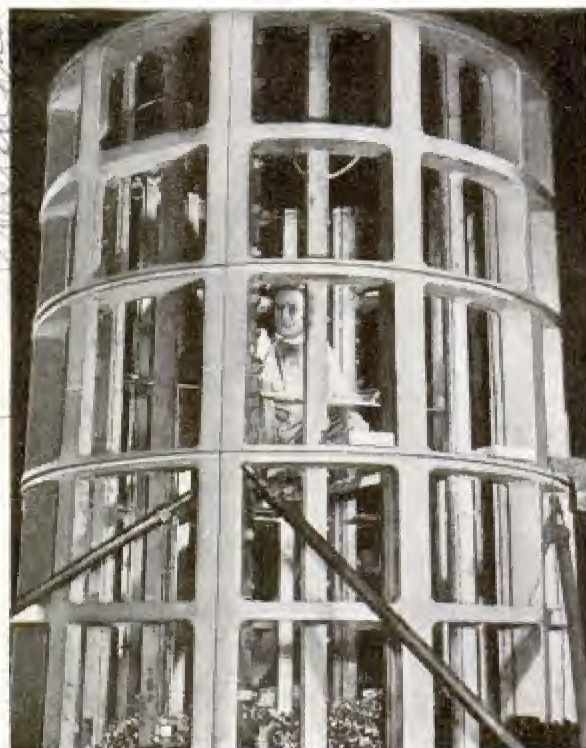
inside—if the management had enough ingenuity to utilize it. But no one has developed that ingenuity yet.

One of the obvious possibilities for direct utilization of solar energy lies in photoelectric cells—commonly called electric eyes. Thus far photoelectric cells have operated with microscopic efficiency and have been very expensive. If someone can make revolutionary improvements in the efficiency and can cut the cost of construction away down, we

The average intensity of solar energy falling on the United States amounts to about 0.1 horsepower per square foot. The energy falling on one square yard of roof would more than operate all the electrical household appliances, including lights, of the average family—if it could be directly utilized. Most factories have enough energy falling on the roof to operate the machinery

might have something there. At present the prospects are discouraging, but one hesitates to say such utilization is forever impossible. Even with the items of efficiency and cost brought under control, the matter of storage of energy during periods of darkness would be troublesome. Large storage reservoirs of water might solve this problem, pumping water to high levels in

Measuring inside diameter of inner frame for hydrogen cooled turbine generator



Atomic power appears distant; here are steel balls that represent atoms in crystal



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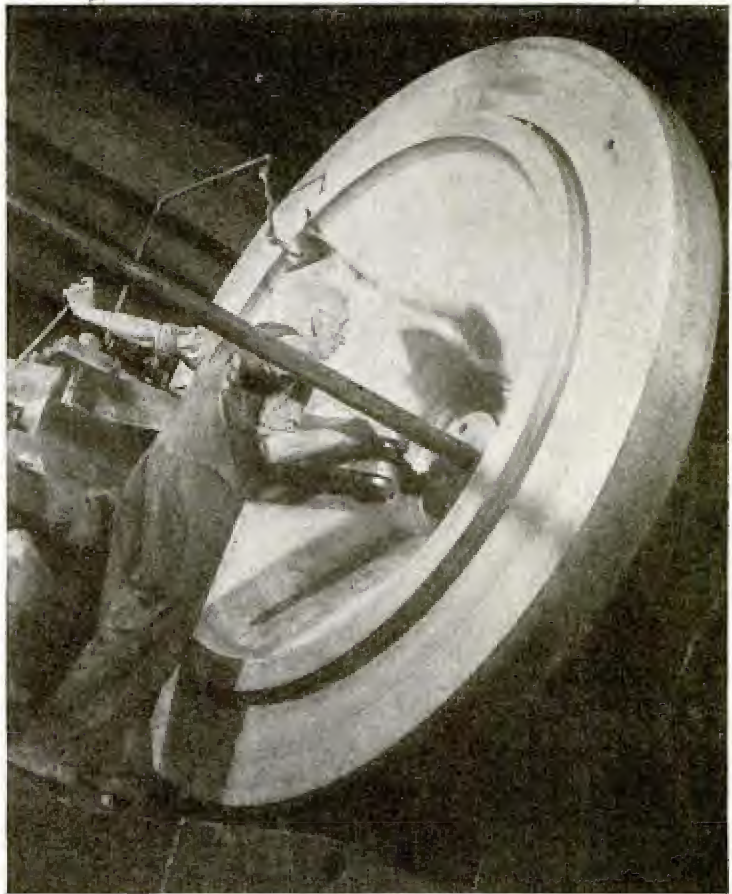
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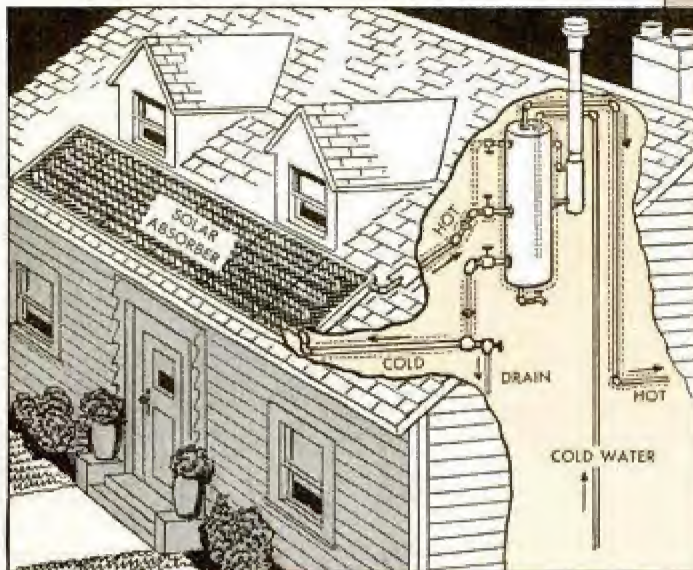
daylight hours and using it in water turbines during darkness. The over-all efficiency of such storage can be about 70 percent.

The simple and obvious device of using focused sun's rays to heat a liquid has been toyed with for a long time. Solar boilers of various degrees of impracticality have been the children of many inventors' minds and the subjects of many patents. Dr. Charles G. Abbot of the Smithsonian Institute has a small solar power plant with revolving parabolic mirrors for which he claims an electrical energy production efficiency of about 15 percent. We'll have to do better than that if the sun's rays, which are not at very high intensity to begin with, are to be a practical source.

On the other hand, solar energy may very well be on the verge of being practical



Shaft flange of generator capable of producing 36 ↑ million watts of electricity at Tennessee Valley dam
Westinghouse photo

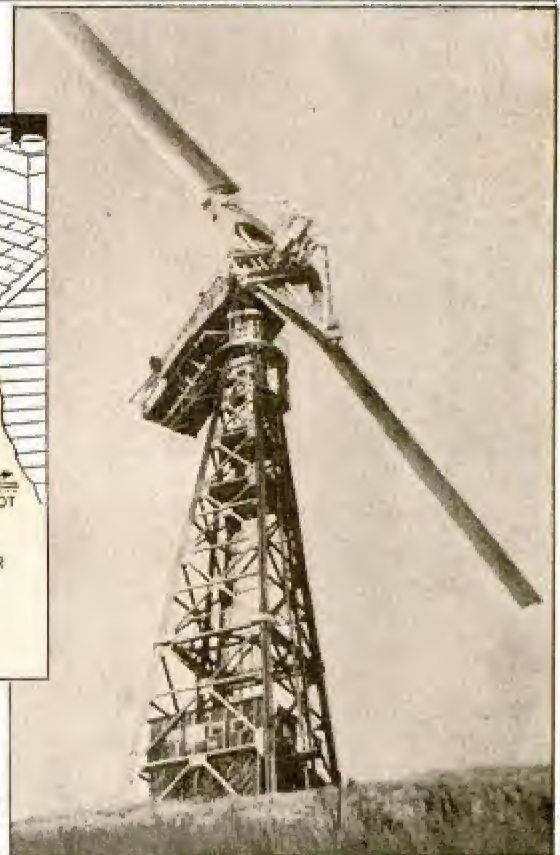


Sketch of home water heating system in which the rays of the sun are utilized

Courtesy U. of California

Large plant at right is used for converting wind power into electrical energy

Courtesy S. Morgan Smith & Co.



MARCH, 1942

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Mr. E. W. Mendenhall, Asst. Dir. of Research, Smithsonian Institution

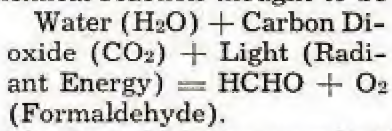
E. W. Mendenhall, Smithsonian Institution



Measuring strength of ultraviolet radiations in the July sunshine

Institute of Technology began experimentation along this line some time ago.

These ideas are interesting, but here is one that I consider the best—men should try to do efficiently what nature has been doing inefficiently for a billion years—utilize photochemical reaction. The basis of all life is some photochemical reaction thought to be



The formaldehyde immediately forms simple sugars which then serve as the basic material for the multitude of complex compounds in plants. What we should like to do would be to take some such simple compound as formaldehyde formed with the help of radiant energy, put it in an electrochemical cell, expose it to oxygen, and

← Soldering coil ends on stationary part of a big turbine generator

Out of the chemist's test tubes may come key to future power supply



W. W. Mendenhall, Smithsonian Institution

for heating of buildings where a high potential is not important. The storage capacity must be sufficient for weeks or even months of operation. A basement full of hot water, periodically reheated by sun's rays, might be possible but it hardly sounds practical. I think that a closed cycle employing a low-boiling liquid might better serve for such storage. First costs would be high, but operating costs might be cut to the vanishing point. The Massachusetts



Mr. E. Bruce Ashford, Smithsonian Institution

21336

then reverse the above reaction and get back the stored energy as electrical energy—at high efficiency. Formaldehyde can be oxidized in a cell in a basic solution to give formic acid and a small amount of electrical energy. Perhaps all that is needed is a proper catalyst to complete the oxidation to CO_2 and water and get back all the stored energy. The catalyst which nature uses for performing the photosynthesis of the above equation is chlorophyll. That's the best catalyst known, but it's very poor. Plants are very inefficient storers of energy. Even the most luxuriant plants have an energy storage efficiency of less than two percent. We ought to do a lot better than that.

It's a wide open field, this study of photosynthesis and the study of oxidation cells which will reverse the reaction. That's the reason it's hopeful. The systems which might be used would not have to be limited to organic compounds. It may well be that inorganic compounds offer the most hope. The satisfactory system would need to be one that is as light sensitive as the chemicals on a photographic film, as easily reversible as a lead storage cell. If such a photochemical-electrical system can be developed, the problem of energy capture and storage would be solved. The storage of the energy would be simply that of storing chemical compounds. We are used to doing that with coal.

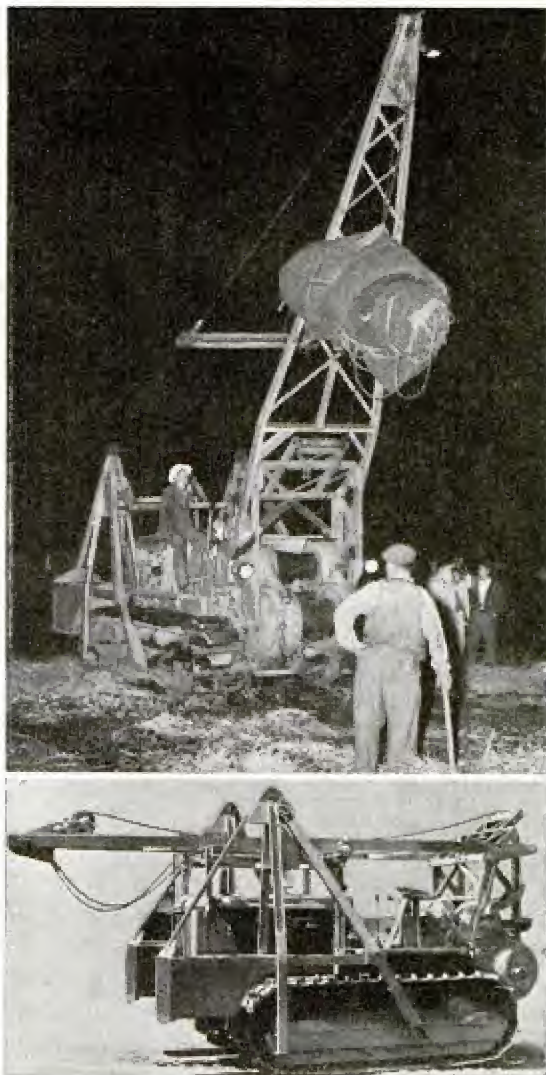
If we wait too long to start working on the problem, we may be caught short as other supplies of energy dwindle. We are using something over a billion barrels of oil per year; the known reserve of oil in the ground is 12 to 15 billion barrels. True, new discoveries are being made constantly, but they are not quite keeping pace with use, so the pinch of partial depletion may come sooner than the optimists anticipate. When the pinch comes, there are several possibilities to be considered. First, getting all the petroleum out of the ground. Even with the best production methods, over half of the original petroleum deposit still stays in the ground after the well has gone dry. If someone will devise an inexpensive means of taking this oil out of the ground, he will lengthen greatly the life of our resources. Second, there is shale oil. There are many billions of tons of oil shale in this country which when heated will yield from half a barrel to two or three

(Continued to page 187)

MARCH, 1942

21352

Folding Crane for Tractor Handles Large Loads



Crane, top, hoisting huge canvas roll. Bottom, it does not interfere with use of tractor when folded

Your tractor now can be fitted with a folding crane which is always ready for service, yet may be lowered out of the way so it does not limit the vehicle for other purposes. It can be mounted easily on several types of standard tractors, and it takes only a minute or two to lift the 20-foot boom for crane service or to lower and fold it on top of the tractor. The crane is made in four models, three with 20-foot booms and one with a 15-foot boom, with lifting capacity up to 10 tons. A large circus uses the boom for lifting huge rolls of canvas and other heavy objects, as well as raising mired trucks and wagons. Then, with the boom folded, the tractor is available for towing and spotting wagons.

Williamette Hyster Co. 2902 N. E. Clackamas St. Portland, Oregon

21332.

Push-Button Cigarette Case Built Into Steering Wheel



Arrow points to cigarette ejected by pressing button

For convenience of the driver, a cigarette case built into the De Soto automobile makes it easy for him to reach for a "smoke." The holder forms part of the molded-plastic steering wheel, and at the touch of a button it "hands" out a cigarette. It dispenses 14 before it needs refilling.

21338

Safety Gasoline Pump for Drum Refuels Auto Quickly

Danger involved in filling fuel tanks from a drum is reduced with the use of a hand-operated rotary pump now available. The portable pump, weighing about 20 pounds, locks firmly on any gasoline drum.

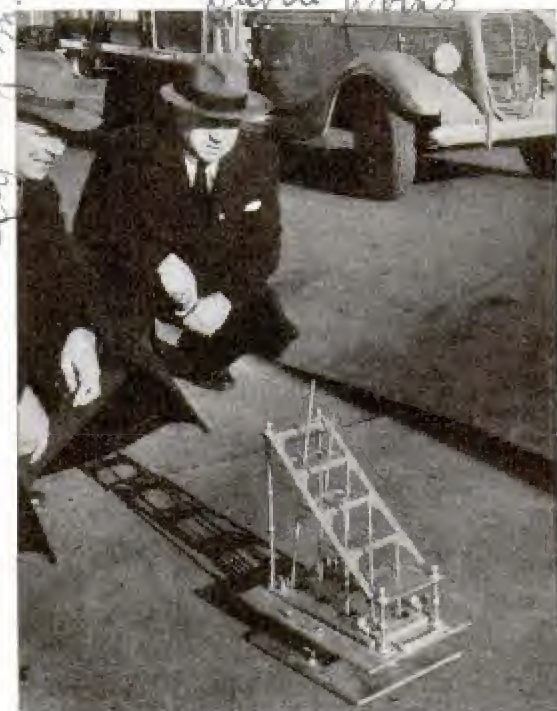


Hand pump makes filling station out of gasoline drum

Cent. Milton F. J. Geny
425 Kasota Bldg. Munn.
It is designed to meet the needs of farmers, truckers and other large gasoline consumers who store fuel in drums on their own premises. The fuel is drawn upward through a pipe extending to the bottom of the drum and is delivered to the tank through an eight-foot hose, giving the user the facilities of a filling station.

"Falling Pin" Seismograph Shows Degree of Street Vibration

To study the vibrations of a street in St. Paul, Minn., city officials unearthed a long-unused "falling pin" seismograph, a little-known instrument once employed in testing the degree of ground vibrations



Number of pins toppled shows severity of vibration

during blasting operations for excavations and other works. Residents nearby had complained of the rumble of passing trucks and asked that heavy vehicles be barred from the street. The instrument, mainly a small sheet of plate glass, was erected on the sidewalk in level position with the aid of four set screws. Stood upright on the glass were eight quarter-inch steel rods ranging in height from five to 12 inches. Had the street been afflicted by "traffic ague," all of the rods would have fallen; but in this instance, passing vehicles caused only the tallest rods to topple, indicating vibration was not excessive.

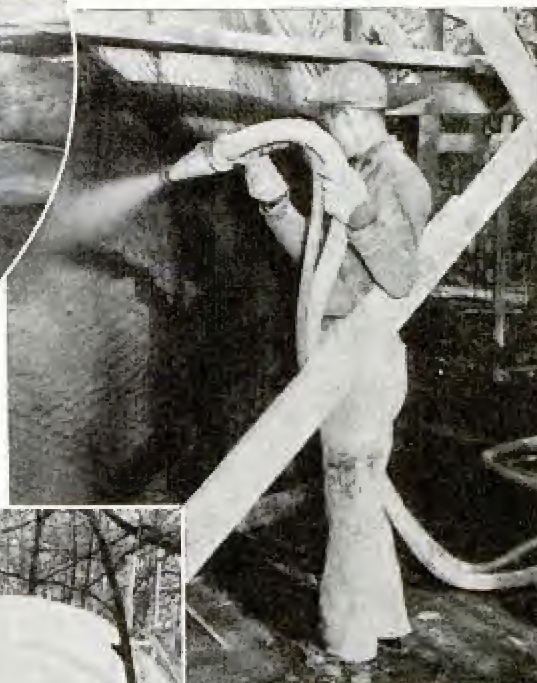
21350

Concrete "Gunned" Over Balloon Forms Igloo



At Falls Church, Va., a colony of unique concrete igloos offers economical housing for war-industry workers. One hemisphere contains two bedrooms, the other a living room; between is an entrance hall, bath and kitchen

Over a concrete base, workmen lay out the rubber-fabric form to be inflated, then sprayed with concrete



At left, inflated form is being covered with wire mesh; above, Guniting operator shoots concrete over it. Goodyear designed the balloons, which can be a hemisphere or semi-cylinder in shape. It is estimated that 200 houses could be erected in 90 days, using only four forms, which are removed and used again as concrete house takes shape

MARCH, 1942

Case Construction Co.

San Pedro

Only

See Rubber G. in Amer. Arch.

Capt. Allen Warren Elliott, 3439 33rd, New York

21238

SUPER SAILORS for the SUBS



IT TAKES iron men to operate the steel fish which comprise the submarine fleet. Just now, with the nation's shipyards turning out underwater craft at a new high rate, the critical problem is to find super-sailors for the subs.

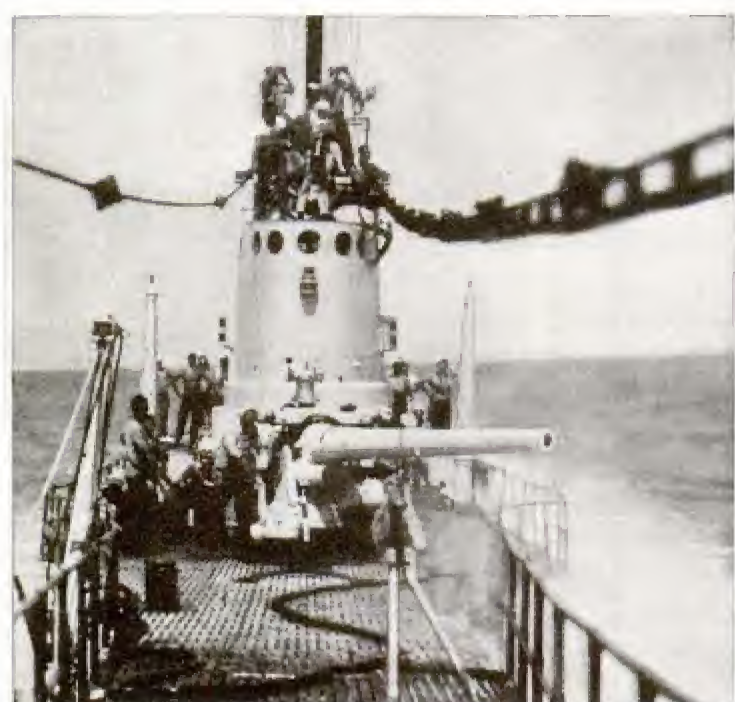
Many are being trained at a remarkable school which the navy operates at the submarine base near New London, Conn., on the Thames River. Huge as it is, with building after building giving the appearance of a large league university, the school has done well up to now to turn out two or three new submarine crews a month, so fine do its mills of knowledge grind.

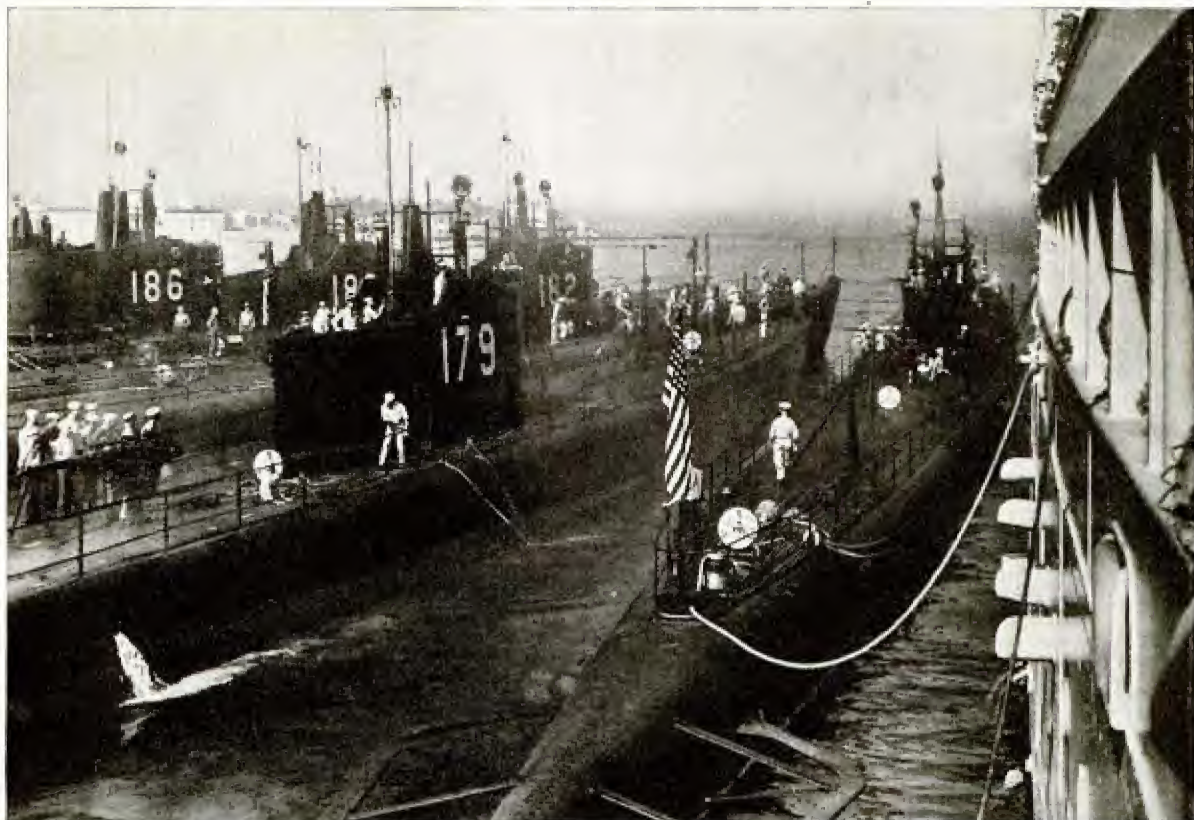
Before a man can be considered for sub service, he must have passed rigid navy recruiting tests, entered the service, served long enough

Flag hoists are used to teach meaning of signal flags used on warships

Deck scene aboard a submarine; note crew members manning the gun ↓

Right, dummy helps teach how diving dress is worn, also how to descend





Some of the newer types of American submarines tied up at their base

Student turns globe to learn effect of earth's rotation on axis of gyroscope

to get a fine record, and then must have made up his mind that the extra hazards and discomforts which naturally go with undersea fighting are especially attractive to him.

"Be reliable" is the slogan of the training station and signs bearing these words are scattered throughout the buildings. But the secret of the success of its graduates at their chosen careers is that it is not enough for a man to be reliable at one submarine job. He must be reliable at two tasks at least, so that one crew of 40 men is the equal of 80 or more. A gunner, for example, might double as a quartermaster and he must be perfect in both jobs.





This is single cell of submarine battery; it weighs about 1,600 pounds

man failure at a critical moment aboard a submarine. If these doctors can find nothing the matter with him, the supreme test comes—the compression chamber. When they finish this test, five out of every hundred candidates pack their bags and go back to the surface ships where they belong. They have everything it takes, perhaps, except the ability to stand pressure which always builds up when a steel fish slides below the surface of the sea.

It seems that because of one ailment or another, sometimes so trivial as to escape notice, the tubes which run through the bones of the head become clogged or closed. When air at a pressure of 50 pounds enters one of these tubes and is suddenly blocked, the pain which builds up is excruciating and the compression chamber test discovers whether this condition exists.

Half a dozen men, more or less, are placed in the chamber. Steel doors clank shut, making it airtight. Then compressed air is gradually

fed into the chamber. The men are told to raise a hand if they feel pain, or have trouble in standing the pressure. Most of them stand it quite well.

Occasionally a sailor will raise a hand, indicating pain. He will be told to blow

But, for this double reliability and double competence, Uncle Sam pays extra salary and many a sailor, not interested in the long grind which it takes to become a chief petty officer on a surface ship, swings into the exciting submarine branch. That is, he swings to the submarine branch if he has already demonstrated in the navy that he is the type who can be depended upon in a pinch.

Presuming that he has passed the navy examinations, served efficiently, shown his dependability and is finally accepted as a candidate for the submarine school, one day he packs his bag and travels to New London.

The first thing he finds here is that all of his physical tests, which permitted him to enter the navy, count for nothing. A corps of physicians pound and thump, prod and poke, seeking a physical defect which may cause hu-



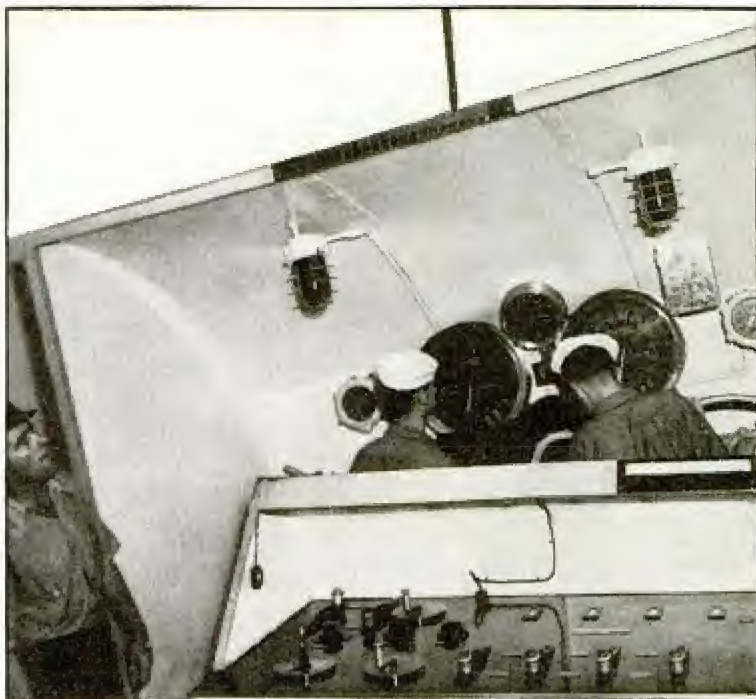
Group of candidates about to be tested in the compression chamber

his nose lustily. This often clears the tubes. Or he will be shown how to grind his jaws sideways, which may relieve his discomfort. But once in a while none of these standbys helps and the candidate will turn pale with pain, often scream with agony. A signal is given, the pressure is dropped, he is led out of the chamber—and that is the end of the submarine service for him.

Another interesting test is given in a water-filled steel tower at the base. The candidate, wearing artificial lungs with attachments clamped over his face, is led into a lock, or airtight chamber at the bottom of the tower. The chamber's outer door is closed and, at a signal, the inner door is opened. Water rushes in and when the chamber is filled, the sailor is supposed to shove out calmly and rise to the surface of the water at the top of the tower. Most of the men have no trouble if they have passed the compression chamber test.

(Continued to page 186)

Candidates not only scrub their uniforms, but diving dress, too



Training device being used by candidates to obey instructions to surface ship. Inclinometer (atop hood) shows the upward angle. Trainee taking orders from instructor in course designed to teach him how to answer control signals; controls are like those on sub.



21331.

Cut-Out Figures of Plastic Outlined for Easy Sawing

Service Cut Out



Sawing figure from plastic sheet requires only care in following the outline. Foreground, two samples

Craftsmen with little experience can produce artistic cut-outs from plastic sheets by simply following the outlines stamped on the sheets. The projects include lawn ornaments, bird houses, wall decorations, signs, cabinets, plaques, trays, magazine racks and window boxes. Made in Masonite they range from 12-by-12 inches to 18-by-24 inches. The only tool needed is a scroll or jig saw, and the edges can be shaped with sandpaper or a file.

21181

Body Temperature Low at Night, High in Mid-Afternoon

After taking their temperatures 10 times daily for a year, two physiologists at University of Chicago, Drs. N. Kleitman and A. Ramsaroop, have reported that their average body temperature was at its peak in mid-afternoon and coldest in the middle of the night. The extremes did not always occur at the same hour each day, and the body-temperature range during 24 hours varied from less than one, to more than two degrees Fahrenheit. These levels were

not affected by changes in external temperature when it remained below 70 degrees, but above that point body temperature would fluctuate with the external temperature. By shifting their sleeping periods three to four hours forward or backward, the scientists found they could shift the time of the daily temperature extremes. The transition required one to two weeks.

21372

Album for Viewing Color Slides Uses Reflected Light

Without removing them from the album, an entire collection of Kodachrome transparencies can be inspected with daylight or any desk lamp as the light source. Each page of this special looseleaf album consists of two hinged rows of frames holding the slides. To examine any row of pictures, you raise the frame and slip under it a combination mirror and ground celluloid unit. When the viewer faces the light source, light strikes the horizontal mirror and is reflected through the celluloid to the Kodachrome slide, illuminating it.



Mirror base of triangular unit seen in lower photo reflects through ground glass under Kodachrome

POPULAR MECHANICS

Desk: Von Lengerke & Antoine

Wabash, Chicago

Hollow Wooden Blocks Simplify Wall Building

Hollow wooden blocks glued together introduce a new method of building without the usual framework, with the additional advantage of broad flexibility of design. Called Plycell blocks, they have a basic face-size of 12-by-12 inches, although other dimensions are available to meet special design needs. So true are their proportions that the "bricks" are said to be self aligning, the only essential being that a level foundation be prepared. For instance, the manu-



Lightweight blocks of wood are easy to handle and fit into wall, above. Left, view of completed house

good insulation, but this may be filled with insulating materials to meet specific requirements. To allow for plumbing, wiring, and so forth, the inside plywood faces may be left unattached until after such installations have been made.

Furred spaces can be provided for plumbing and heating wherever necessary. All doors, windows and built-in features become united with the blocks as if molded in one piece. There is hardly any limit to the possible interior and exterior wall finishes, since the units lend themselves for special prefinishing treatment in the factory or the desired finish can be applied after completion of the structure.

facturer states that the first building erected did not have a single wall lined or trued during construction. All units are wooden frames to which are glued plywood faces that project equally on all sides, forming a continuous groove to receive splines by which one is joined to the other with case-in glue. However, blocks may be designed for attachment by other means if desired. Dead-air space within each block provides

Plant Cuttings Take Root Quickly When Their Stems are Lacerated

Gardeners who want faster rooting from plant cuttings might try abusing the stems, according to recent experiments with coleus and other plants. Using a razor blade Prof. Carl D. LaRue of the University of Michigan slashed the cut ends of some stems almost to a pulp. For comparison a second group was left with the ends clean-cut. Both groups were kept in a

moist chamber for 48 hours, and then the lacerated plants were separated from others before being set out to strike root. The stems which had been badly gashed proved uniform in producing more roots than the clean-cut stems. In a second test, Prof. LaRue made an extract from plant wound tissue with which he treated the ends of cuttings. This, too, had a stimulating effect.

21369 Capt. Thomas E. Stinson Jr.
3872 Frankish Co
FLYING WINGS ARE COMING
120 Jan. 1942 251 Los Angeles



Above, a closeup of center section of the flying-wing plane with Northrop in cockpit. Openings admit air to carburetor and to cool engines



Side view, above, shows tips rebuilt horizontally into the wing; notice extreme thickness of the center section. Spear projecting from apex of wing in the photograph below is the air-speed indicator tube



THE old prospector rubbed his beard and squinted in amazement.

"It's the heat," he muttered. "There just ain't any airplane like that."

Swooping over the California desert was something that looked to him like a monstrous pterodactyl. It had to be an airplane, he finally decided, because he could hear the motors. But it was the queerest the desert had ever seen. It didn't have any tail.

What the prospector had stumbled across was a secret test flight of a new plane that no one except a few Army officers and Northrop Aircraft officials knew about. It was a flying wing that some engineers expect will revolutionize aircraft design. Some predict today's conventional airplane will become as extinct as the pterodactyl that the new flying wing resembles. Already Northrop is getting into volume production on the type.

Designers have been trying to perfect a practical flying wing for dec-

Ref: Lyle Manton
Public Relations Office
Northrop Aircraft Co.
Hawthorne, Calif. 21369



ades because such a craft is about one third more efficient than an ordinary airplane. The conventional tail and fuselage are hindrances to efficient flight, but the tail group has been necessary for control, and the fuselage necessary to hold the tail behind the wing. Both elements form a drag that holds the wing back from the speed it could attain by itself.

A number of flying wings have been built, one as early as 1914, but all were hard to control. Even a flying wing needs control surfaces and the only places to put them are at the wing tips. This creates a short coupling that results in bad spinning characteristics. Such flying wings are perfectly stable in smooth air but

(Continued to page 190)

In flight, the great sweepback of the wing is seen. Notice control surfaces in wing tip and the clean lines of this craft when its tricycle landing gear is retracted. Below, its pusher engines hidden from this angle, it is shown in contrast with a conventional monoplane



L1329

Fixed Telescope Focused by Movable Mirror

Miss Dorothy Olson



↑
Mirror, center, may be turned to bend ray from any star into ten-inch lens of telescope

← "Seeing end" of telescope. Dials, left and right of eyepiece, control movement of mirror

matically turns the mirror so it reflects the image of the selected star into the 10-inch objective lens of the telescope. Delicately balanced mechanism that controls the mirror is powered by nine electric motors of $\frac{1}{10}$ horsepower or less. Pressure of a button then

One of the world's most unusual telescopes, never pointing to the heavens since it is immovably mounted in horizontal position and constantly pointing northward, has been set up for visitors at Buhl Planetarium in Pittsburgh, Pa. The siderostat telescope, as it is known, can be focused on any star or planet that may be in position for observation. This is accomplished with the aid of a mirror mounted directly in front of the telescope. Instead of aiming the 12-foot tube, the observer merely adjusts a pair of dials according to instructions in a guide book and thus auto-

causes the mirror to follow the star across the sky. Pushing another button starts a recorded voice's story of the star at which the spectator is looking. While gazing into the eyepiece, the visitor sits in an enclosed room. Actually there are six interchangeable eyepieces, ranging from 65 to 490 power. These various powers have different uses. For instance, 490 power might be put on the telescope when viewing a comet invisible to the naked eye, and the 65-power used for looking at Saturn or Jupiter. The instrument is not for experts, but for the enjoyment of the general public.

POPULAR MECHANICS

1201 W. Wrightwood
Chicago

Arthur L. Grafe
Director

Don't forget to
see this
Café

17

Formulas for colored paints are worked out in laboratory prior to large-scale mixing in paint division of Pittsburgh Plate Glass Co.

2222 Frank O'Leary

L1040 Leggett

Color bands identify different elements in bit of metal or other substance analyzed with spectrograph



Colored light in a show window may attract more passersby than white light, even if the same wattage is employed. Electric signs in brilliant colors get more attention than those using ordinary incandescent lamps. Of course, novelty is a powerful factor in attention value.

Even the packing house finds it wise to use color. Traditionally the walls of packing house showrooms have been white and the sawdust-covered floors yellowish. Looking at white surfaces produces a gray after-image and looking at yellow results in other objects taking on a bluish tinge. Thus, beef in the showrooms seemed gray-blue, quite un-

By Matthew Luckiesh, D.Sc., D.E.

Director of Lighting Research Laboratory,
General Electric Company

see Jan. 1942 Colorate.
18
Nela Park
Coneland
KNOWINGLY or not, everyone demands color. The appeal of color is utilized, consciously or not, by everyone who produces for sale anything in which color is naturally or even artificially a factor. Artists, craftsmen, manufacturers and merchandisers utilize the powers of color and colors. In advertising and merchandising, the appeal of color has naturally been given much attention. In these activities, color has adequately been proved to have definite monetary value.

Operators of restaurants, tea rooms, taverns and night clubs believe that dim lighting—subdued coloring—induces guests to linger; that lighting with lamps producing a rosy glow seems to soften the guests—and ease their purse strings.

attractive to the meat purchaser. The color engineer steps in and paints the walls blue-green and covers the floors with green sawdust; the contrasting after-effect accentuates the redness in the meat and increased sales result—another illustration of how color is being put to work.

In five years a publication increased its income from colored advertisements 75 times; four-color pages of advertising increased from about a dozen to more than 1,400 annually, proving the appeal of color.

Small articles made of plastics are colored during the manufacturing process



L10 40

19

Sometimes more work will be done where muscular activity is required if the proper colors are employed. Exhaustive tests have shown that red has a stimulating effect on human beings, with less stimulation for orange, yellow, green and blue, in order. Taking ordinary white light as 100 percent, the tests showed the increase in muscular activity: 104 percent under blue illumination; 121 percent under green; 130 percent for yellow; 159 percent for orange and 187 percent for red.

Colors can perform many services in the factory—aid sanitation, encourage group hygiene, relieve monotony, make work rooms seem cooler, stimulate workers and contribute toward productivity, contentment and happiness. Painting machines and parts of them in certain colors will tend to reduce accidents; painting the surroundings appropriately will make the workers more cheerful. To feel cool is highly desirable in places where work is performed, so we might apply a "cool" color scheme such as: gray green for dado and lower portions of columns and possibly for machinery; medium tint of pea green for upper walls and other large vertical surfaces; near-white for the ceiling—either a mere suggestion of yellowish green or even a cream, and a medium tint of pea green for structural beams to give the feeling of support. If there are many beams, aluminum paint may be satisfactory—and it gives a modern touch.

A combination of warm and cool color schemes is obtained by means of light buff or partially subdued yellow on the upper walls and a shade of yellowish green on the lower



Westinghouse
Spectrograph uses photographic film in analyses of unknown materials

Closeup of portable color-and-light demonstrator developed by General Electric Company, Nela Park, *Cleveland Ohio* for home lighting specialists



21040

Model cars enable the Ditzler Color Co. to show auto makers how colors will look on the finished product. This is a natural-color photograph



greenish blue. The warm colors are those between scarlet and yellow, with the maximum warmth in the region of yellowish orange or orange. Use of the cool colors and of cheering colors which are at a maximum in yellow, would seem appropriate in hospitals.

In the general office there is no outstanding point of attack. Exposure, simplicity, maintenance and lighting are all worthy of consideration in

20 walls. A band separating the upper and lower walls may be of light brown or of a shade of yellow green.

In the hospital, glossy white has reigned a long time, owing to a narrow efficiency viewpoint. A glossy paint is washed easily and white not only suggests cleanliness, but reveals the lack of it. Since nature is relied upon as an aid to getting well, hospitals should bear some semblance to that which is natural. This means the substitution of a reasonable degree of colorfulness for the unnatural white. Cool or warm color schemes are readily utilized; the cool colors being those between violet and green, with a maximum coolness near a

a color scheme. Some light should come directly from the ceiling or an equivalent. Perhaps the common extreme plainness of ceilings should be relieved by means of simple painted or molded patterns. In general there is no justification for lack of colorfulness. The cool color schemes appear to be more generally applicable in the work-world, notwithstanding the prevalence of very subdued buffs. Northern exposures in an ideal office building might well have windows glazed with glass of a warm yellowish tint—not amber. In summer, when the windows are open, this warmth of color vanishes, but is present in winter because the windows are closed.

Insulated wires are colored differently to distinguish one circuit from another

L. E. Jensen studio



This striking color shot shows tank in which various liquids form color mixture. (Photo courtesy Pittsburgh Plate Glass Co.)

Pittsburgh Plate Glass Co.





Striking example of how colored illuminants are employed to "paint" buildings attractively at night

21
L1040

Desk tops might be painted a warm gray or in other subdued colors but they should not be dark colors. There is no reason why typewriters and adding machines should not be colorful, at least warm grays. Executives will find office production greater, workers more cheerful and fatigue less if the surroundings satisfy the esthetic sense, if the furniture and the machines are appropriately colored and if the lighting is such as to reduce eyestrain. Ease of seeing is a phase of considerable breadth, including not only vision but impressions.

In fields where colored or tinted light is desirable, the fluorescent lamp has opened

Working with colored plastics in General Electric laboratory





21040.
ad May 1942
up entirely new and interesting possibilities. The fluorescent lamp is a tube in which a powder is activated by ultraviolet rays. Functioning as a transformer, the powder absorbs these short-wave, invisible ultraviolet rays and re-radiates this energy at greater wavelengths which become visible within the color ranges of the spectrum. Differences in the chemical content of the powder result in different colors of emitted light, making it possible to produce colors from the pastel tints to rather pure ones. One type produces the nearest approach to natural daylight ever achieved by an efficient artificial illuminant for general lighting purposes.

Stores, offices, factories, theater interiors, hotel dining rooms and lobbies, specialty shops, art galleries and numerous other establishments are putting color to work with the aid of this tubular lamp. Color discrimination and many forms of color-matching are done under light from daylight fluorescent lamps.

Any merchant would be able to serve his customers better by installing a color-demonstrating box, which he can have made at a low expenditure. A simple form consists of two compartments. In one are installed colored lamps—red, green, blue, yellow and white—with switches and louvers to control the individual lamp so that combinations of colors may be produced. A diffusing glass separates the lamp compartment from the other compartment and into this second compartment (with white walls) the customer may look at the color which is being produced. By proper records or scales the merchant may duplicate the same color at any time. The color box

Pat. 2238316. circ. in card file under
"Color Helm" is a handy device for anyone dealing with colors.
Patelle Inc. Ridgewood, N.Y.
58 W. 40 St. New York City
Closest approach to true black is obtained by lining box with black velvet, covering exterior with black paint and cutting hole in front. Hole appears much blacker than surrounding area.
Chicago Artists Supply Co 578 Wacker



Colored particles employed in paint are dried by means of filter press, shown in use

would be a valuable aid in helping customers to choose materials to reproduce the color or to harmonize with it.

The automobile is an outstanding example of the growing demand for color and of the manufacturer's reaction to that demand. In the early days of auto body building, only a few colors were used, with the manufacturers offering a great preponderance of black cars. That a great change has occurred is perfectly plain to anyone who watches the rainbow-hued parade along our highways today. When few colors were used in the industry, they were presented in small swatches glued to a pocket-sized card. As time went by, color folders became the order. Then came a new idea—colors in small cabinets with individual color swatches visibly filed according to color family. This arrangement was forced into the background by metal panels which carried a better picture of the actual finish. Then one company began displaying color on quarter-size replicas of motor car doors, following up this idea with model cars in one-eighth size. The miniature automo-

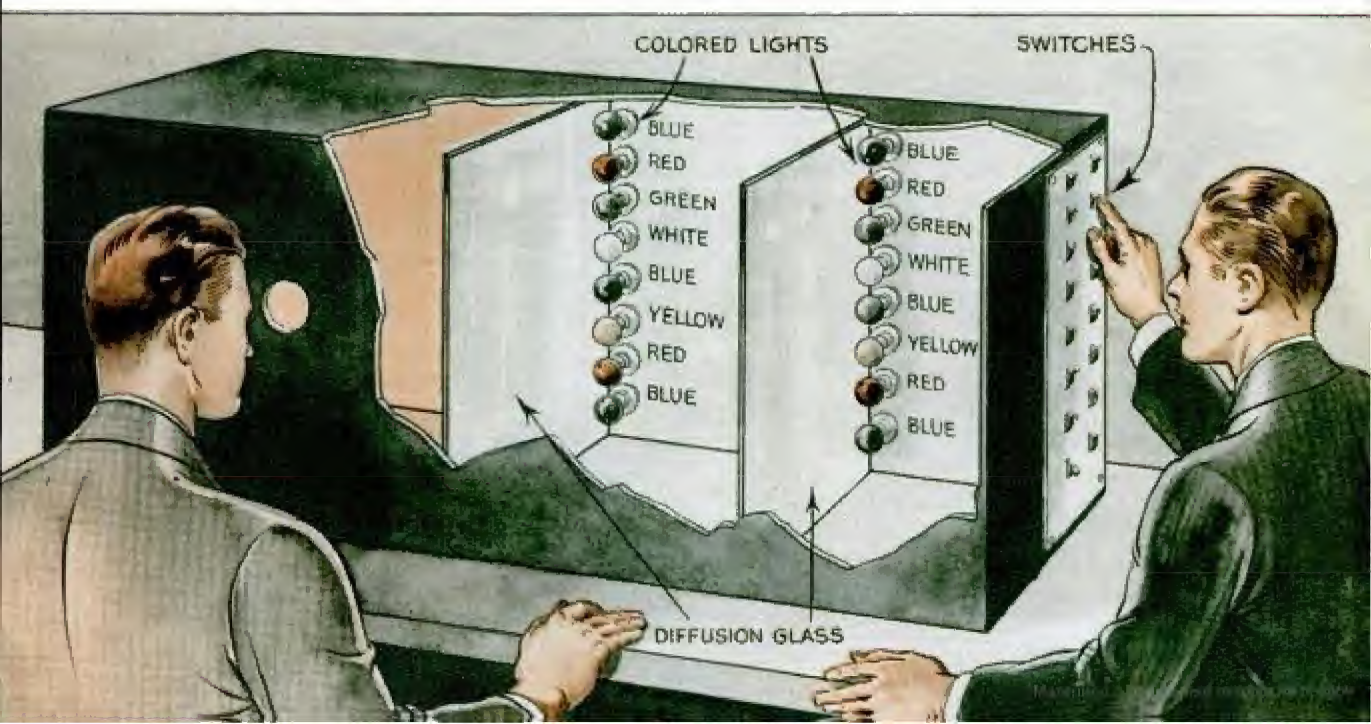


biles are the result of an effort to bring out the over-tones and under-tones of colors as affected by highlights and shadows.

Streamline trains, street cars, trackless trolleys and buses also reflect the growing demand for color, both inside and out. Most of the gay-hued trains carry capacity loads of passengers and crowds still throng the right-of-way of one brightly-painted streamliner that has been in service many months.

Another way in which color has been put to work is found in the story of an oil company doing an export business in India.

One version of simple color-demonstrating box that merchants would find handy. Observer looks through aperture until color desired is created by means of light combinations





Color photo of fluorescent tubes under test in General Electric plant

Oil was sold in tins for use in lamps at the time this trade was inaugurated. Apparently someone advising the company knew that the natives held the monkey in high esteem and that they liked red. So a red monkey was printed on the sides of the can in which the oil was sold. The result was that the natives hung the tins in their humble huts for enjoyment of the red color and in reverence of the monkey. Undoubtedly more oil in that kind of can was sold in India than in other kinds, for obvious reasons.

The possibilities of color application are virtually unlimited. Paints, dyes and light are the sources of many thousands of colors, tints and shades. For instance, if only reflected color is considered, such as in painting and decoration, 10,000 colors are available. One dictionary of color contains specimens of 7,000 colors, with the color charts of paint, dye and silk manufacturers showing still less. The 10,000 reflecting colors are increased to an almost unbelievable number when the influence of lighting is taken into account, because each color becomes a different color, in the broad sense, when the intensity of illumination is altered. Thus a very extensive series of shades of any color is produced by changes in level of illumination. Compared with this series, that ranging from white to black on an artist's palette is meager indeed.

Interior decorators must

(Continued to page 176)



The author originating appropriate color schemes for enjoyment of color in work-world

21362

57-Ton Tank Displays Mighty Crushing Power



This could happen to an enemy truck attempting to impede the United States Army's latest heavy tank

Another defiant fighter was welcomed to the armored ranks of the United States Army when the first 57-ton tank of the M-1 type rolled off the assembly line at the Baldwin Locomotive Works in Eddy-

stone, Pa. In one of its first demonstrations the Big Bertha of mobile weapons smashed a truck under its tracks as if it were an eggshell. Production of this tank has been speeded to meet the nation's war needs.

Space-Saving Hat and Coat Rack Fastens to Wall or Door

Closet space can be saved with a hat and garment holder which may be attached to the back of a door or on the wall. The hat rest is shaped to fit inside the crown of the hat, and the arm is notched for hangers.

Zinc Oxide May Reduce Carbon In Gasoline Engines

Zinc oxide may be the means of reducing or eliminating carbon to a minimum in gasoline engines, according to a patent assigned to the Standard Oil Development Corporation of New York. The inventors claim that if the parts on which carbon usually forms are coated with zinc oxide, they will resist the deposits of carbon. The zinc oxide coating may be applied in various ways: the parts may be electroplated, subjected to vapors of metallic zinc, or galvanized by treating them with molten zinc. The zinc is finally converted into zinc oxide by an oxidizing agent.



Hat and garment rack shown in inset may be mounted on wall or behind the door to save space in closet

MARCH, 1942

25

26 Broadway
New York City

Patented by Edward B. Park
Elizabeth N.Y.
P.O. Box 1000
New York City

Cryler mfg Co
4115 Ravenswood Ave
Chicago

The **EMERGENCY PATROL**



Volunteer antiaircraft squad follows planes over city with searchlights ↑

Police sergeant in emergency car directs rescue drill over loudspeaker ↓



WAR quickly taught Europe the airplane had at last brought conflict to the doorsteps of the civilian and not even the most efficient army, navy and air forces could prevent bombing behind the battle front.

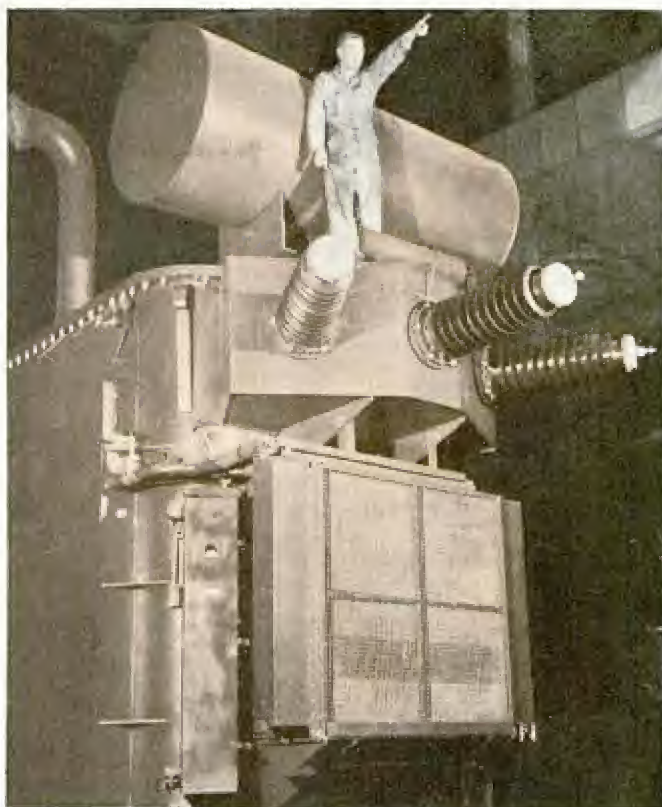
But not until the United States found itself actively engaged did the nation begin to realize that just as the armed forces could not prevent air attacks on cities, neither could experienced firemen and policemen handle the emergencies brought about by explosive and incendiary bombs in which 1,000 fire bombs usually mean 100

21361
bomb fires. Regardless of the efficiency of the trained forces, civilians must take a hand in their own defense. The time may come when every able-bodied American citizen, male and female, will be required to assume some protective duty in the army behind the army.

The bigger the city, the better the target. This was discerned early by officials of America's largest metropolis, New York City, with 7,500,000 people exposed to attack. For more than a year, behind the facade of business as usual, a feverish campaign of preparedness for civilian defense had been going on.

The day America entered the war, over 115,000 air raid wardens, more than 25,000 auxiliary firemen, and thousands of technical specialists—a civilian defense army numbering more than 200,000—were ready for duty in New York City.

From this blueprint the rapidly expanded civilian defense army of the nation has been constructed,



Mobile transformer capable of supplying electricity for city of 70,000 can be rushed by rail wherever power shortage exists

Volunteer firemen, below, attach trailer fire pumps to taxicabs



Warrior Sales. chas
420 Lexington Ave. New York
1361

Warrior Portable Isardes
Road Breaker.



Holding a sandbag in front of his face for protection, a civilian fireman drops it on an incendiary bomb. This should smother it in two minutes

One member of rescue squad (right) wields a portable, gasoline-driven drill to loosen a wall while another attacks the woodwork with an electric saw

From the tops of skyscrapers around New York, thousands of air-raid wardens—many with "walkie-talkie" radios (below)—watch for enemy planes



with its now familiar homespun firemen, air raid watchers, communications experts, and rescue squads.

What may be in store for the average American as the civilian defense program expands is indicated by the intensive advanced training given volunteer auxiliary firemen in New York. To ordinary fire fighting, first aid, morale building, house wrecking and rescue work, were added new problems inflicted by war hazards. They were taught that every building over 75 feet high in New York is required to have a water tank on the roof, with a standpipe reaching to the sidewalk. If a blast shattered the water main, they were to fasten a hose to the lower end of a standpipe and attach it to the engine. A 5,000-gallon standard tank provides a 20-minute stream.

Fire department lectures dealt with the hypothetical situation in which all the mains had been shattered near the center of Manhattan island and several large fires were burning. The men were shown how hose lines could be stretched to the Hudson river and the

East river and water pumped for many blocks by relay pumpers every 2,500 or 3,000 feet. Civilian firemen studied the location of bathing pools, the use of portable tanks and stationary water supply vats, bucket brigades and stirrup pumps. They were given instruction on emergency treatment for smoke inhalation and burns and first aid for fractures and wounds. They were instructed in the use of splints for fractures and tourniquets to stop bleeding, and how to apply bandages.

Practicing in gas masks, firemen learned the necessity for decontamination after exposure to mustard gas, the fact that blisters caused by Lewisite gas must not be broken or they will form again, and the first rule in treatment of tear gas—to keep from rubbing the eyes.

Air raid watchers spent hours spotting "enemy" planes from skyscrapers. First aid groups clambered through wreckage with "victims" on stretchers. Decontamination experts practiced on gas-impregnated ground. In the army information center, calls were received from many of the 1,500 observation posts around New York, and along the Atlantic seaboard 40,000 civilian spotters helped chart the course of aircraft simulating attack on New York City.

Meanwhile engineers were appraising the vulnerability of the city with the most large buildings of any civilized community. They found these very skyscrapers were the greatest safety factor in the city. Except for the top six floors and the vicinity of roofs on setbacks, no better air raid shelters could be planned than the tall buildings, because the path of a dropped bomb is oblique and it is likely to be diverted from the side of a building if it strikes. Above three floors, the danger from flying debris would be



↑ Steel-helmeted doctors and nurses of New York City hospitals practice and train others for emergency first aid work

↓ Volunteer firemen go after an incendiary bomb with acetylene torch to cut roof, rope for rescues and two-way radio



21361



↑ Emergency calls about utility damage clear through this liaison office



← Volunteer decontamination squad neutralizes a gassed area with sand and chloride of lime

New York's emergency car is equipped with rescue and wrecking tools, oxygen and masks



nil. Half a dozen supporting columns could be blasted from a structure like the Empire State Building and it would stand firmly, they estimated. Concrete and steel floors would resist bomb penetration.

The city's 11,000 taxicabs were organized into an emergency group which volunteered for evacuating women and children, giving first aid, and transporting fire-fighting equipment if needed. Technical, engineering and art schools inaugurated classes in camouflage and light control, and disguise of strategic buildings, air field, gun emplacements and raid shelters.



Patrolmen in New York City are trained to work in gas masks →

dummy mines usually, but with active mines substituted and exploded occasionally to complete their training.

Detailed plans for supplying the metropolitan area with the necessary 40,000,000 pounds of food daily were worked out by William Fellowes Morgan, Jr., Commissioner of Markets, and his staff. Maps and statistics were drawn to show how, for example, if the Holland Tunnel were smashed, foodstuffs ordinarily carried through this artery could be lightered across the Hudson river, or trucked over a bridge. Systems were worked out so that several weeks' supply of essential foods will be available, and questionnaires filled out by wholesalers indicated how much provender would be necessary if transportation lines to the outside were crippled.

Civilians were advised to duck under a stout table if caught in a vulnerable building during an air raid; to keep suitcases packed ready for a quick departure; keep bathtubs full of water, have stir-

(Continued to page 193)

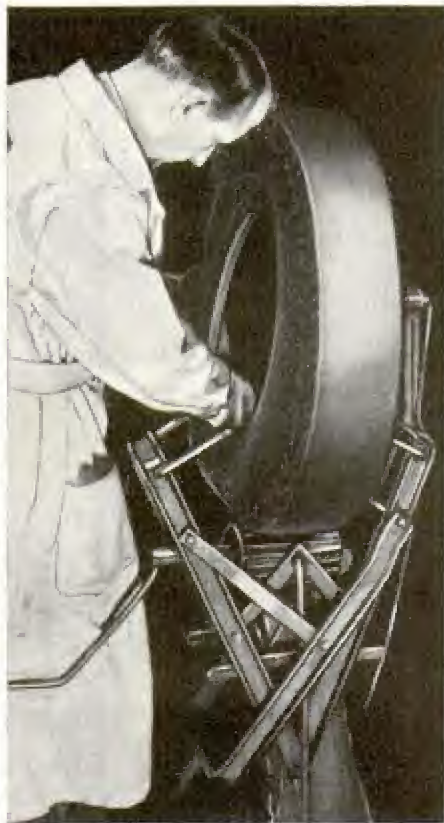


Above is one of the probationary firemen wearing an oxygen type helmet, in which he can virtually "eat smoke." More than 25,000 auxiliary firemen are being trained for war work

At left, a squad of the auxiliaries piles aboard an emergency truck for a fire-fighting drill

21389

Retreading Lengthens Tire Life, Saves Rubber



With rubber precious and tires rationed, motorists can add 80 percent to tire mileage at half the original cost by retreading. First step (top) is to buff off old rubber tread

Above, inspecting tire before deciding to retread. Below, at left, applying new tread to casing; right, vulcanizing tread in a mold, without heating sidewall or shoulder. About half as much rubber is used as in new tire

Photos from Firestone Tire & Rubber Co.

Chromolux



21264

Power Shovel Designed With Transparent Cab

not on market



Plastic bodied power shovel, with transparent cab, will have telescoping arm as shown in sketches

Industrial Designers, 664 N. Maple

Previous notions of design and established precedents were set aside by designers in creating the body for an entirely different power shovel. As drawn by Barnes & Reinecke of Chicago, industrial designers, the structure is of colored molded plastic, to be capped by an unbreakable crystal-clear cupola from which the operator would have full vision in all direc-

tions. Broad tracks, operated independently forward or backward, would give the vehicle easy maneuverability in deep mud and on rough ground. The shovel would swing at the end of a telescoping tubular steel boom, to provide a wide range of digging operations from a given setting. A compact thousand-horsepower Diesel motor would furnish power.

21260

Army Plants Mines With Coal Chutes Mounted on Trucks

In recent maneuvers at Wadesboro, N. C., men of Company C, Fifth Engineers, used a simple means for laying land mines intended to stop tanks and scout cars. Common coal chutes were mounted at the rear end of the trucks and the antitank mines were fed to the road one at a time while on the go.

Engineers of United States Army experimenting with the use of ordinary coal chutes, mounted at the rear of trucks, to accelerate the laying of antitank mines. Strewn in the path of an advancing or pursuing army, these land mines would slow up tanks and other motorized vehicles



club

1227

How to CUT Your HEATING BILL



Putting storm windows on your house will save as much as 63.8 percent of the heat escaping through windows. Below, taking temperatures at floor and at the ceiling. Differences exceeding four degrees indicate inefficient heating



Blowing insulation into wall results in saving as much as 72.6 percent of the heat escaping there



1712 By Milton Figen
1712 - 8th Ave. Minneapolis

HUNDREDS of millions of dollars worth of fuel are wasted annually in this country by home owners and dwellers who fail to take advantage of common and long accepted devices for saving heat. Among such devices are insulation, weather stripping and storm windows.

Exactly what do these forms of protection against heat waste mean for the average home?

Milton S. Wunderlich, chief of the research staff of the Insulite Company, Minneapolis, Minn., and owner of what he calls the "Electric Skin House," has been using this house for six years as a laboratory to determine exactly where heat losses occur in the average home and how much they amount to. He has gone to considerable expense in equipping his home to test not only the different ways in which heat es-

Builder's Exchange
Bldg.

also Johns. Manville Co 22 E 40th New York
782 Baker Bldg. Minneapolis

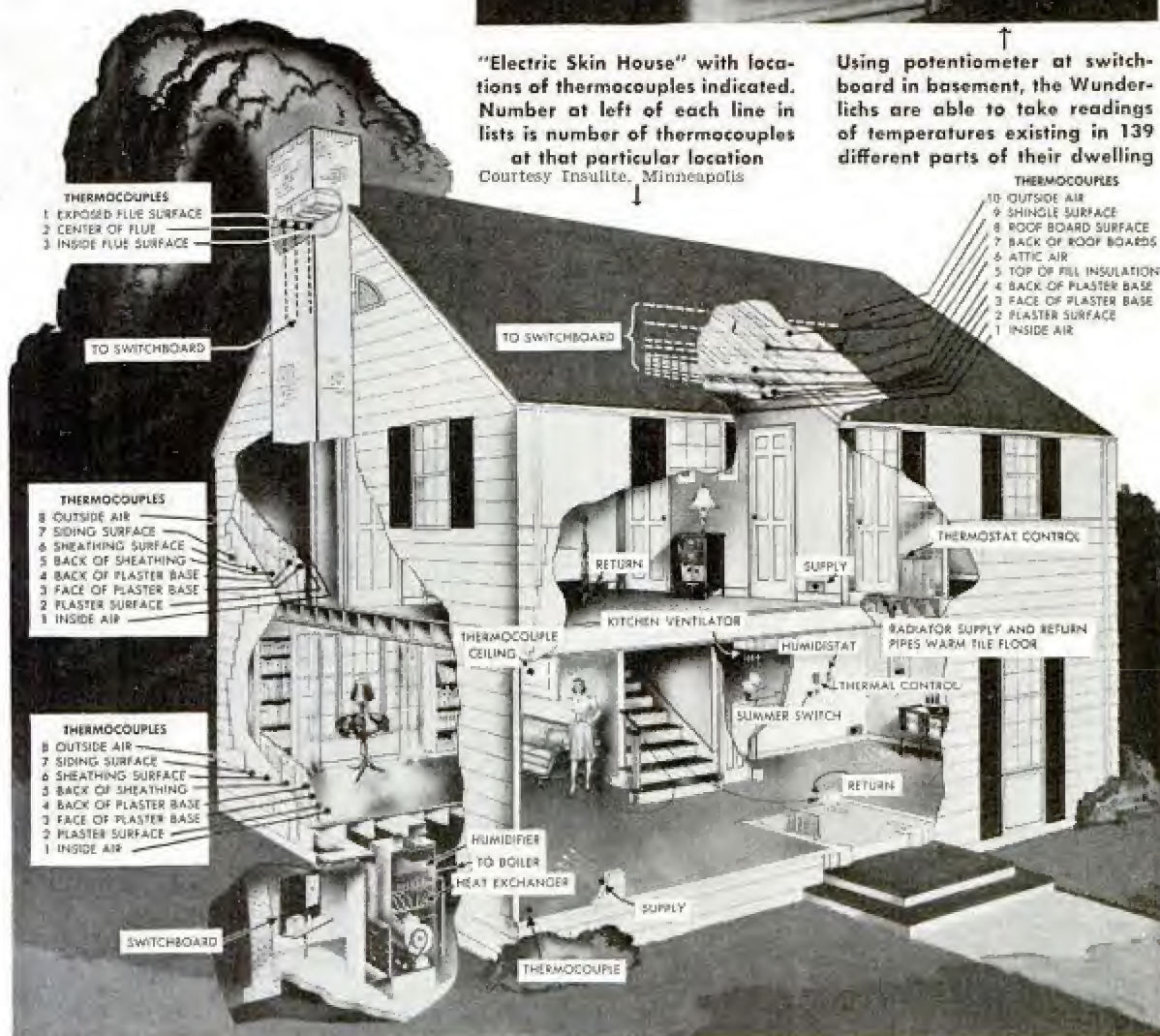
capas but also the effectiveness of the different devices commonly used to check this escape. Most important among Mr. Wunderlich's equipment are the instruments which, because of their hyper-sensitivity to temperature changes, have gained his home the name of Electric Skin House.

These instruments are called "thermocouples." One hundred and thirty-nine of them are distributed over the house. Inconspicuous to the uneducated eye, the thermocouples are simple loops of delicate wire composed of two differing metals. Each thermocouple has a "detecting" end and a "receiving" end. The detecting ends, when ex-



"Electric Skin House" with locations of thermocouples indicated. Number at left of each line in lists is number of thermocouples at that particular location
Courtesy Insulite, Minneapolis

Using potentiometer at switch-board in basement, the Wunderlichs are able to take readings of temperatures existing in 139 different parts of their dwelling





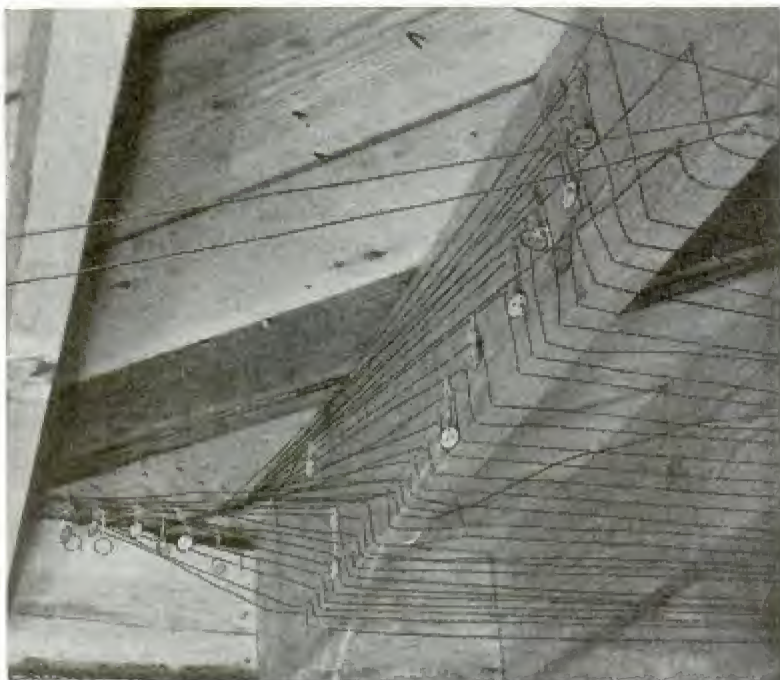
By installing weather stripping, average dweller can save as much as 45.6 percent of heat lost through cracks around windows and doors

posed to temperature changes at the points where they are located, generate a small electric flow. This flow can be measured at the receiving ends with an instrument called a potentiometer and the degrees of heat or cold existing at the opposite or detecting ends of the thermocouples are thus calibrated. All receiving ends are located at a central terminal board, somewhat resembling a telephone switchboard, located in the basement.

By seating himself at this central terminal board, Mr. Wunderlich is able to "plug in" his potentiometer and check up on the temperatures existing at 139 points in his home. The installation of this electric skin thermocouple system has given him, in effect, more power to "feel out" his home and to study its reaction to all kinds of weather changes than any man has ever had before.

The installation entailed the stringing of more than 12½ miles of the delicate wiring. The "couples" detect temperature changes at all points of the house where heat losses are likely to occur. In

Closeup of thermocouple wiring attached to basement ceiling; 12½ miles of such wiring is in the house



all four outside walls, as well as in the ceiling and roof, loop ends were placed in groups of eight and ten at graduated depths through these exposed parts of the house. By thus being able to read temperatures existing in the interior of the walls as well as on their surfaces, Mr. Wunderlich could calculate the resistance to the escape of heat offered by the various materials of which the walls were composed. The same is true with regard to ceiling and roof. Once the "resistances" were measured, the exact amounts of heat lost through each square foot

of the "shell" of the home was easily determined.

Still other thermocouples were so placed as to detect not heat loss to the outside but any variations existing in the temperature of the heat being distributed through the interior of the home. For this purpose at least four "couples" were placed in each room: one in each vent delivering heat, one in each vent exhausting heat, one at an outside corner of the ceiling and one at an outside corner of the floor.

L1227



Double candle test, with candle at bottom and another at top of the stairs, indicates drafts; constant, draftless heat is efficient



Wood fiber insulation board not only is protection against attic heat loss but also is good plaster base for walls of extra attic room

Proper insulation of attic will save the average dweller as much as 71.4 percent of all the heat escaping through roof of house

From these thermocouple readings, other tests made, and accurate records of fuel consumption kept, a wealth of illuminating information comes to light, information helpful to everyone who would like to cut the cost of his fuel bills.

Completely insulated in both walls and attic, the eight-room 23,000-cubic-foot Electric Skin House costs \$72 a year to heat. The heating season lasts seven months. Average daily temperatures run around 30 degrees F. All window and door openings are thoroughly weather stripped. The home has two stories, is of wood construction. A combination of air conditioning and steam heating is used. Oil is used for fuel. Factors to be borne in mind in judging the home are that it is considerably above average in size; it has all standard protections against heat losses (insulation, weather stripping, storm windows); also, the home is exposed on all sides with nothing to serve as windbreaks; and, finally, the automatic character of the heating controls (thermostat) helps to keep the fuel consumption down.



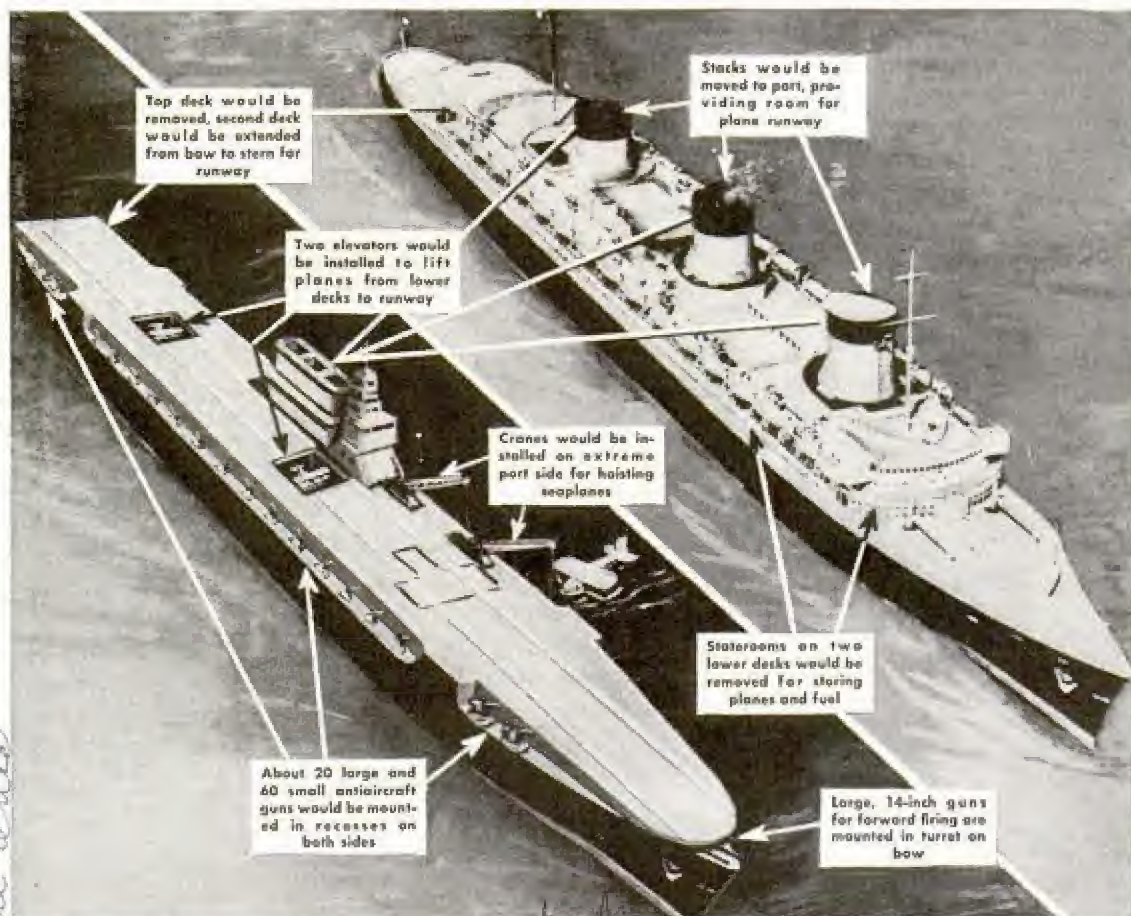
Effective as weather stripping is, the largest single source of heat loss is through the cracks around windows and doors. Approximately 29.7% of all heat escaping from the house is lost in this way. In dollars and cents this loss equals \$21.38 a year. But if the weather stripping were absent the loss would be \$39.30 a year. Saving in heat prevented from escaping through cracks is \$17.92 or 45.6%.

Storm windows cut down by 63.8% the heat loss through windows, from \$46.70 to \$18.50. But still, the second largest single source of heat loss in the house is windows. About 25.7% of all heat escaping is through

(Continued to page 166)

21281

"Normandie" Cast in Role of Aircraft Carrier



Sketches show French liner "Normandie" before transformation, and how she would look as a carrier

United States naval experts reveal that it would be possible to rebuild the huge French liner "Normandie" into an aircraft carrier within six months. Compared with this, it would require two years to con-

struct so large a fighting ship. The conversion would cost five to eight million dollars. As a carrier, the ship would probably accommodate about 75 airplanes and carry a crew of 2,500.

Heat Lamp to Fit in Pocket Tans Faster Than Sunlight

Tiny but powerful, a miniature heat lamp that may be carried in the coat pocket is

claimed to provide as much sun tan in three minutes as July sunshine does in thirty minutes. The unit is equipped with a high-powered mercury-arc lamp which emits both infrared and ultraviolet rays.



Heat lamp open for use and folded to fit the pocket

Color Photos Tell Fruit Ripeness At Both Ends of Shipment

Color photography is being used by fruit handlers in studies to determine the best time and conditions for picking, storing and shipping fruit. Plums or pears, for instance, are picked at a given stage of ripeness, photographed and loaded into refriger-

POPULAR MECHANICS

U. of California College of Agriculture, Davis, Calif.

Sporti. Inc. Beech and Kenilworth Cincinnati Ohio

with help of Ag. Expt. Sta. D.A.A.

erator cars in California. Some are put in the warmest place, others in the coldest, and temperatures are recorded automatically all the way across the continent. In New York the fruit is photographed again, and the two pictures show what happened to the color in transit. The experiments are expected to help growers select fruit of the proper ripeness for picking and to find the best temperature for shipping and storing.

Camera Truck Has 20-Foot Tower and Rubber Fenders

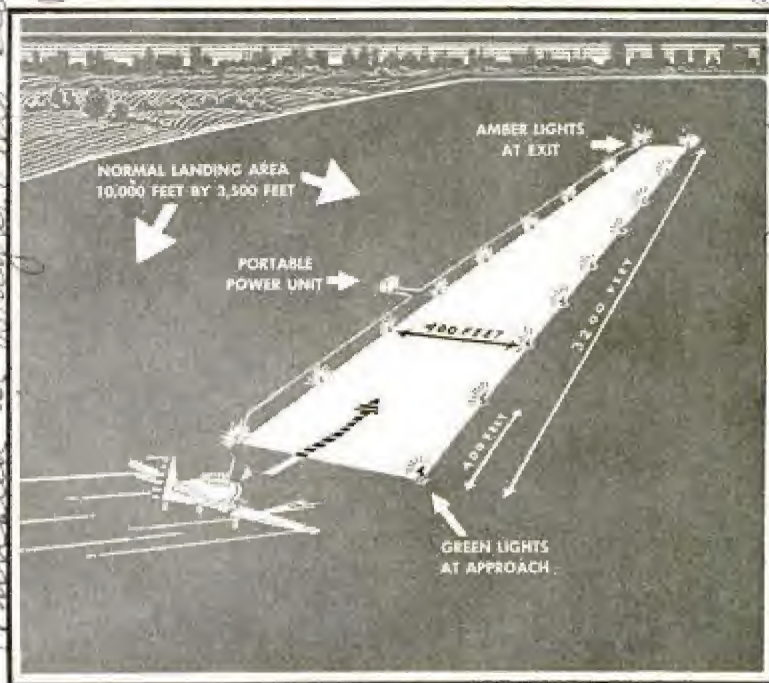
Photographers for the Chicago "Times" can "shoot" the news from a skyscraping platform that extends 20 feet in the air. The hydraulic lift is mounted on a photo truck, and access to the platform is through a trap door in the roof. The truck has flexible rubber fenders over the rear wheels, eliminating a frequent source of repair bills.



Left, shooting picture from hydraulic lift; right, the rubber fender

MARCH, 1942

Portable Landing Lights Invisible To Planes Flying Overhead



Lights on runway can be seen only by pilot making low-altitude approach

Only the pilot who drops down to enter the runway approach can see new-type portable landing lights put into use by the United States Army Air Forces. In fact, they cannot be observed even from a low-flying plane directly overhead. Each hooded light looks like a plump duckling squatting on the ground with a light in its beak. Its beam does not shoot across the landing lane but parallel to it, green lights being arranged at the entrance and amber at the exit. The system calls for steadiness and an accurate approach, but landings are smooth and safe. The lighted area is 400 feet wide and

3,200 feet long. The light standards and the portable power plant can be set up ready for use in 30 to 40 minutes to convert any smooth plot of ground into an emergency night landing field. They can be "rolled up" ready to be moved in ten minutes.

ⓈThe recoil mechanism of a 16-inch coast defense gun, which can hurl a one-ton shell 30 miles, is capable of stopping a 20-ton railroad car traveling 60 miles an hour within five feet.

Compressed 39
Air Nov. 1941

21222.

Leggett

KILOWATT *The New* Hired Hand



Ultraviolet bulbs in reflectors provide artificial light with rays as beneficial to poultry as those from sun

Small portable electric motor performs farm tasks like shelling corn and hoisting hay

new Westinghouse



DOWN on the farm a new hired hand is reducing drudgery and making money for the boss. Silent, tireless and on the job 24 hours a day, this worker demands no high wages, accomplishing for five cents the same amount of mechanical work that any man can do in eight hours. Kilowatt is the name of this efficient helper.

Kilowatts flowing through the power lines serving more than 2,000,000 of America's farms are changing the agricultural picture in an amazing fashion. Hitched up to various equipment and appliances, they perform in a few minutes the tasks that once meant hours of dreary labor. And the farmers who are making the fullest use of electricity today are the farmers who are making the most money.

Electricity is measured by what is

POPULAR MECHANICS

*Westinghouse
Lamp Div. 150 Broadway
New York*

*Carl Hermann Otte manager
Electric House - Electric Poultry Farm*

called a "kilowatt-hour." For the farmer, one kilowatt-hour, used with the proper equipment, will lift 7½ tons of hay into a haymow, churn 100 pounds of butter, wash the dishes for 40 meals or milk 30 cows. And that will cost approximately five cents, less in some communities where rates are lower.

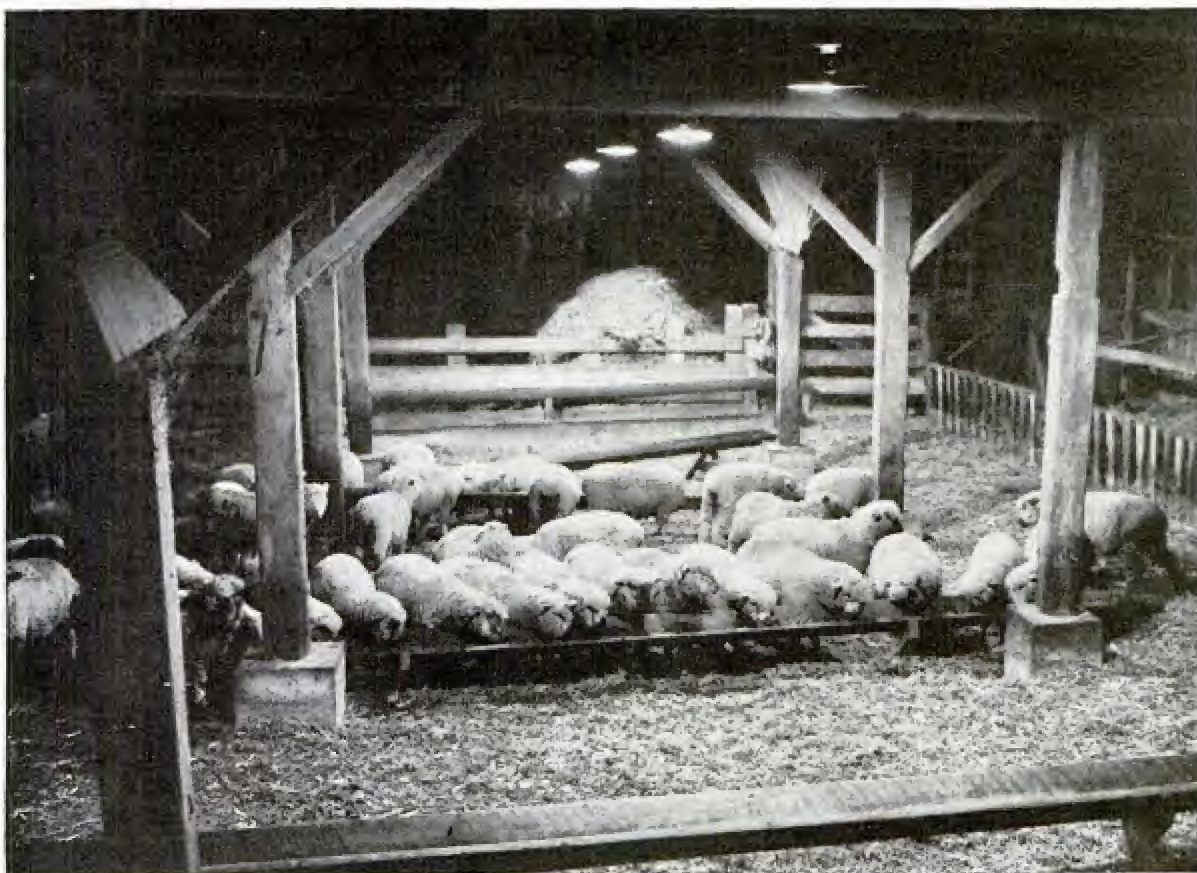
Just how can the farmer make money by using electricity? Let's take a look at poultry raising. On one test farm, where a time clock turns lights on and off to maintain a 12-hour working day, egg profits are 10 to 30 percent greater than before electricity was employed. "Wired help" now wakes the chickens, keeps baby chicks warm, heats their water, grinds and mixes feed, grades and cleans eggs and encourages egg production by turning a ventilating fan that keeps the hens comfortable on warm days. Electric brooders, egg cleaners, portable motors and egg graders enabled this farmer to increase his flock of chickens and double the egg output without increasing the number of hired hands. And the cost? One egg per day pays for the electricity



Here the portable motor does the lifting, enabling one man to handle the hay (Westinghouse photo)

*Electric hay hoist - Universal
Towitt Motor Co Cedar Falls
Iowa*

Good lighting is essential in the barn; ultraviolet lamps may be used to supply sunlike rays for sheep in winter



21222

*Helena, R. Peckolchum farming
farm near Webster, N.Y.*



↑
Electric milk cooler eliminates waste of well water formerly required for the same job—and cools the milk better

←
Electric lamp attracts insects and metal grille, charged with 4,000 volts, electrocutes them as they fly into this trap



Electrical mother for these chicks (above) is brooder that takes place of 40 hens. Electrically operated pipeline milker saves labor, frees hired men for other work



used for lighting and for warming water for 300 laying hens.

But that's not all the story. If the farmer uses lamps especially designed to emit ultraviolet rays—they are commonly known as sunlamps—he not only gets more eggs but they have stronger shells, greater food value, better taste and better hatching possibilities. Ultraviolet rays do for the chickens what cod liver oil does for children—makes them healthy, vigorous and fast growing. One 250-watt sunlamp burned three or four hours a day will irradiate 100 chickens with noticeable benefits. And in brooders ultraviolet bulbs furnish heat as well as the health-giving dose of sunshine. One 60-watt lamp burned 10 hours a day will serve 100 chicks.

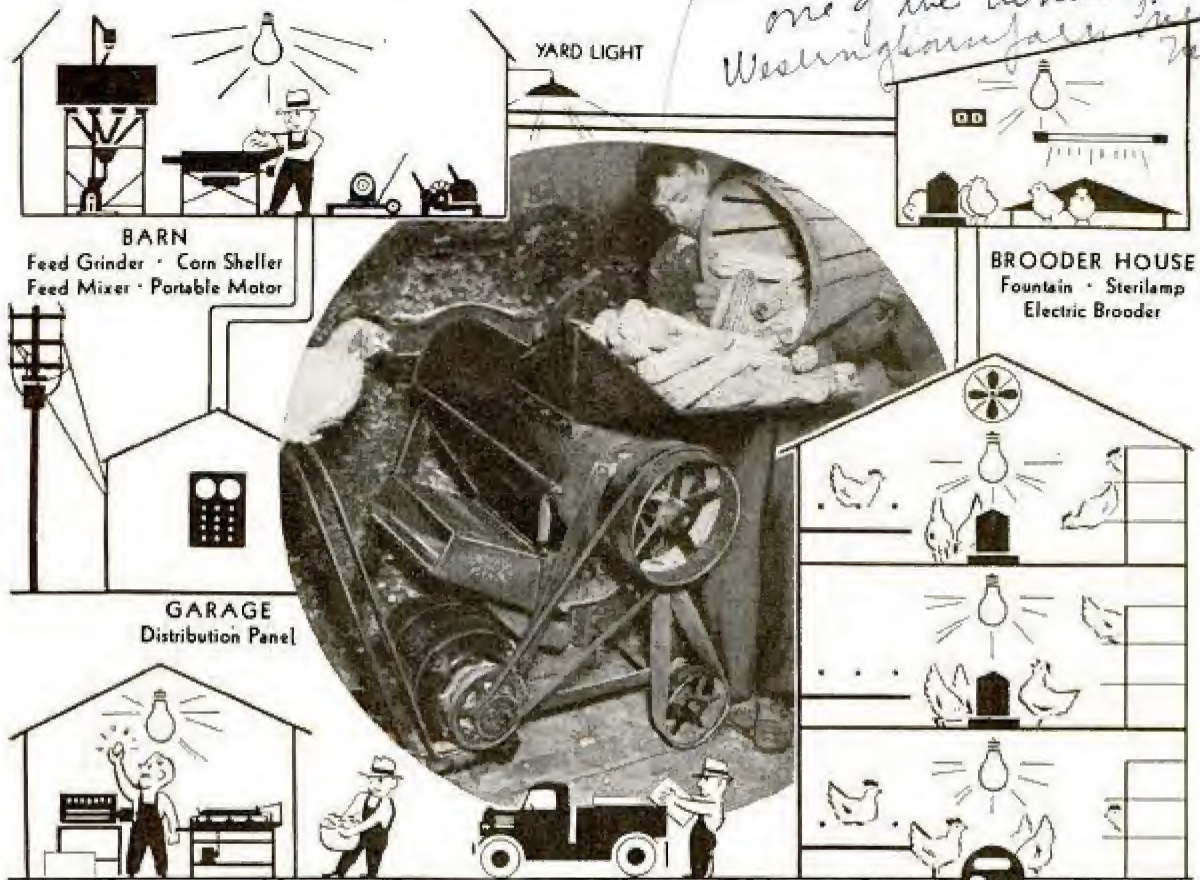
On a Massachusetts farm chicks treated with sunlamps become salable broilers two weeks earlier than other chicks, and eggs from irradiated birds show greater hatchability than those from untreated hens.

In the calving pen, where sick animals must often be doctored and tended, a heat lamp, emitting warm, dry infrared rays, eliminated fetching pails of warm water to the barn, wringing out cloths and applying them. The heat lamp is safer to use, because there is not the danger of catching cold that follows the use of wet applications, especially in cold weather, and is easier to use, in addition to being effective. The heat lamp brings livestock relief from congestion, soreness and pains.

For the calves' pen, a sunlamp installation is recommended. Mounted three or four feet above the calves, a sunlamp burned two hours a day will do the animals as much good as a couple of

L1222

Charles J. Wendig,
one of the owners of
Westinghouse Electric
near New Haven



Drawings show some of tasks electricity can do on a poultry farm. Circle, using an all-purpose two-horse-power motor to drive corn sheller

Ultraviolet light in the brooder is good for growing pigs; thermostat controls lamp (General Electric photo)



hours in the outdoor summer sunshine. Here, as in the henhouse, ultraviolet produces beneficial effects, the calves being sturdy, healthy and fast-growing.

If the farmer's three little pigs are to reach the market in condition to bring a good price, he would be wise to use a heat lamp in the brooder—a 250-watt lamp that provides heat as well as light

(Continued to page 168)

*Under Palace Mobile House -
 Palace Travel Coach Corp.
 308 Hemphill
 Road, Detroit*

Two Rooms and Kitchen Fold Up Into Trailer



Trailer fully opened is given a homey appearance by trellises flanking the doorway

After selecting the homesite, owner unfolds trailer to make two rooms and kitchenette



Acme
 Providing homes for defense workers in communities where large industries spring into being overnight is a problem which the Farm Security Administration may solve by supplying rolling cottages for migrant families. The newest type trailer measures 20 by 8 feet when traveling on the highway, but unfolds to 20 by 19 feet for light housekeeping. A small family can live in its two rooms and

kitchenette and enjoy many of the comforts of a permanent home.

Mileage Dial Shows Distances Between Cities by Car

*Mr. C. George,
 Box 343, St. Petersburg, Fla.*



To find mileage, motorist turns outer dial (top) until name of the city appears opposite arrow (bottom)

Tourists may help themselves to information about the mileage to their destinations by dialing an "information dispenser" just introduced. Installed at a filling station, it saves the time of attendants who might be asked to look up answers to such questions. The motorist simply turns the outer rim, which is printed with the names of towns mostly inquired about, until the name of the town he wants comes opposite the pointer. This automatically brings the mileage to that town into view in a slot. Of course, the wheel must be calibrated to give the correct mileages from the city in which it is to be set up.

Infrared Coating for Flashbulbs Aids "Blackout" Photography

Amateur photographers wishing to take infrared or "blackout" pictures can now coat ordinary flashbulbs with an infrared solution anyone can prepare. The chemicals, each properly weighed, are packed in

*Elizabeth & Sperry
 205 Fulton*

L1196. Cont. Arthur J. Larson,
Dec 34, Portland Ore

Model of Gas Works Tests Plans For Building Large Plant

separate envelopes. All necessary ingredients except water and glycerine are supplied, since glycerine is easy to obtain. One package contains enough chemicals to coat about 50 flashbulbs. Another simple method of using the solution is to make an infrared filter by dipping into it a piece of celluloid, about one-quarter inch thick, and large enough to cover the front of the reflector.

L1223

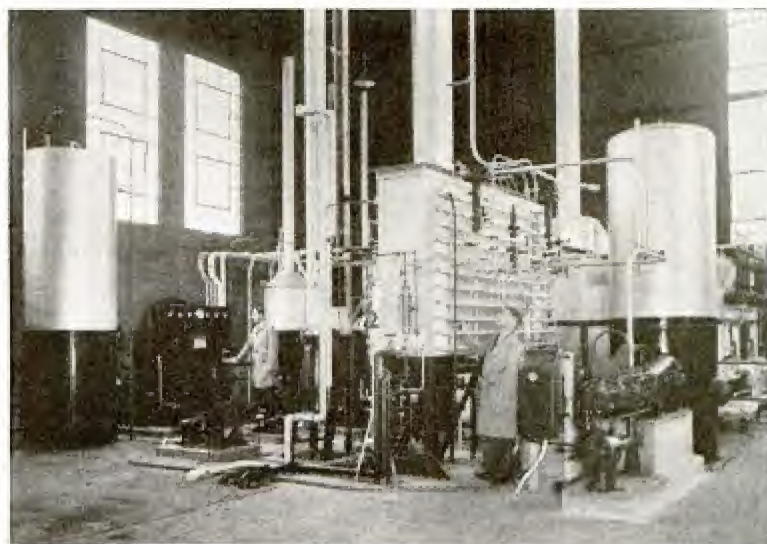
Ambulance on Mule Carries Casualty Back to Camp

When men participating in American war games recently were injured or became ill, they were carried back to evacuation hospitals on the backs of mules. This method was used by the 97th Field Artillery Battalion which still finds a place in the modern mechanized army for the mule. For the trip through woods with its human burden, the mule packed a litter on its back.

marston n. e.



Litter on the back of a mule makes a safe ambulance for injured soldier



This "miniature" plant tests new industrial processes for oil refinery

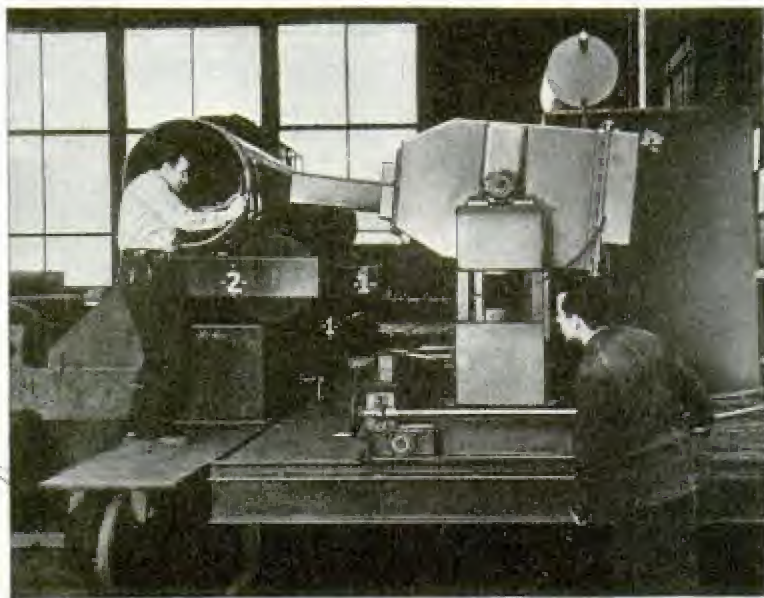
Many a model railroad builder may regard with envy the work of super-model builders who constructed a working miniature of a complete gas works. Built for industrial purposes, the model or pilot plant tries out new methods of cracking oil-refinery residuum, or waste oil, thus bridging the gap between test-tube experiments and expensive large-scale equipment used by the Portland Gas and Coke Company of Portland, Ore. For instance, with the pilot plant it was demonstrated that lampblack, which periodically clogged the gas generator, could be burned out by admitting oxygen as the gas-making cycle ends and while the lampblack still glows white-hot. Formerly it was necessary to shut down the plant and laboriously scrape off the accumu-

lation, a very costly operation. After months of work with this pilot plant, engineers built another and more advanced experimental unit, which proved so foolproof that \$1,500,000 was authorized for a chemical plant which will yield not only gas but ethylene, butylene, propylene and other hydrocarbons, as well as by-products such as benzol for motor fuel, toluol for solvents and TNT, petroleum coke, naphthalene, high-grade road tar, briquet fuel and commercial lampblack.

uoma

21235 General Electric Co
Schenectady, N.Y.

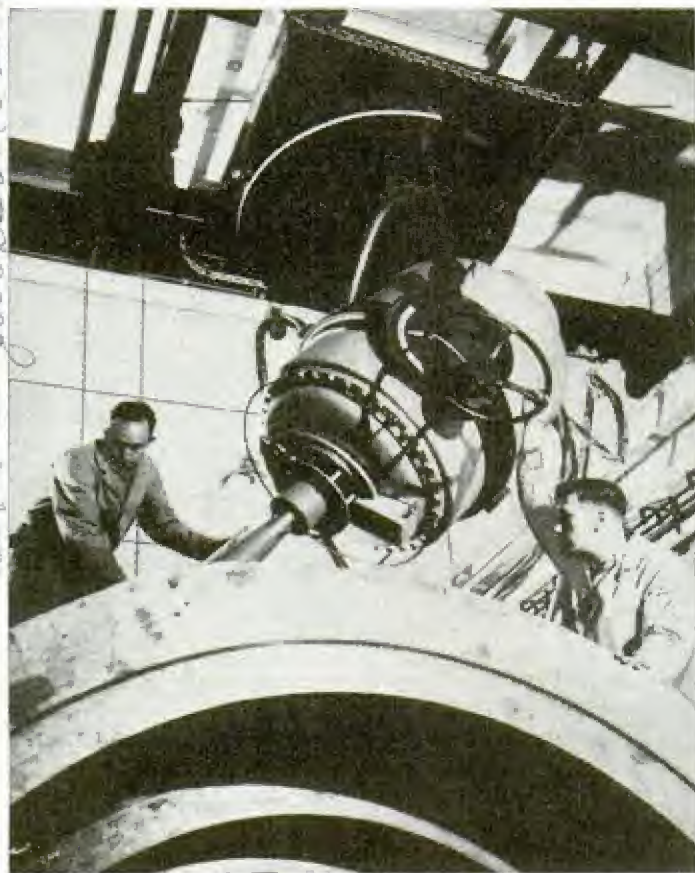
X-RAYS in OVERALLS



One operator places an X-ray film inside a big steel pipe while the other trains the X-ray tube on it. The resulting radiograph will show up internal flaws in the metal, which otherwise might fail in use



Here a mobile X-ray unit is rolled up to a huge boiler casting to turn its seeing eye on it



The million-volt industrial X-ray machine is turned at a 45-degree angle to inspect a casting in the General Electric laboratory

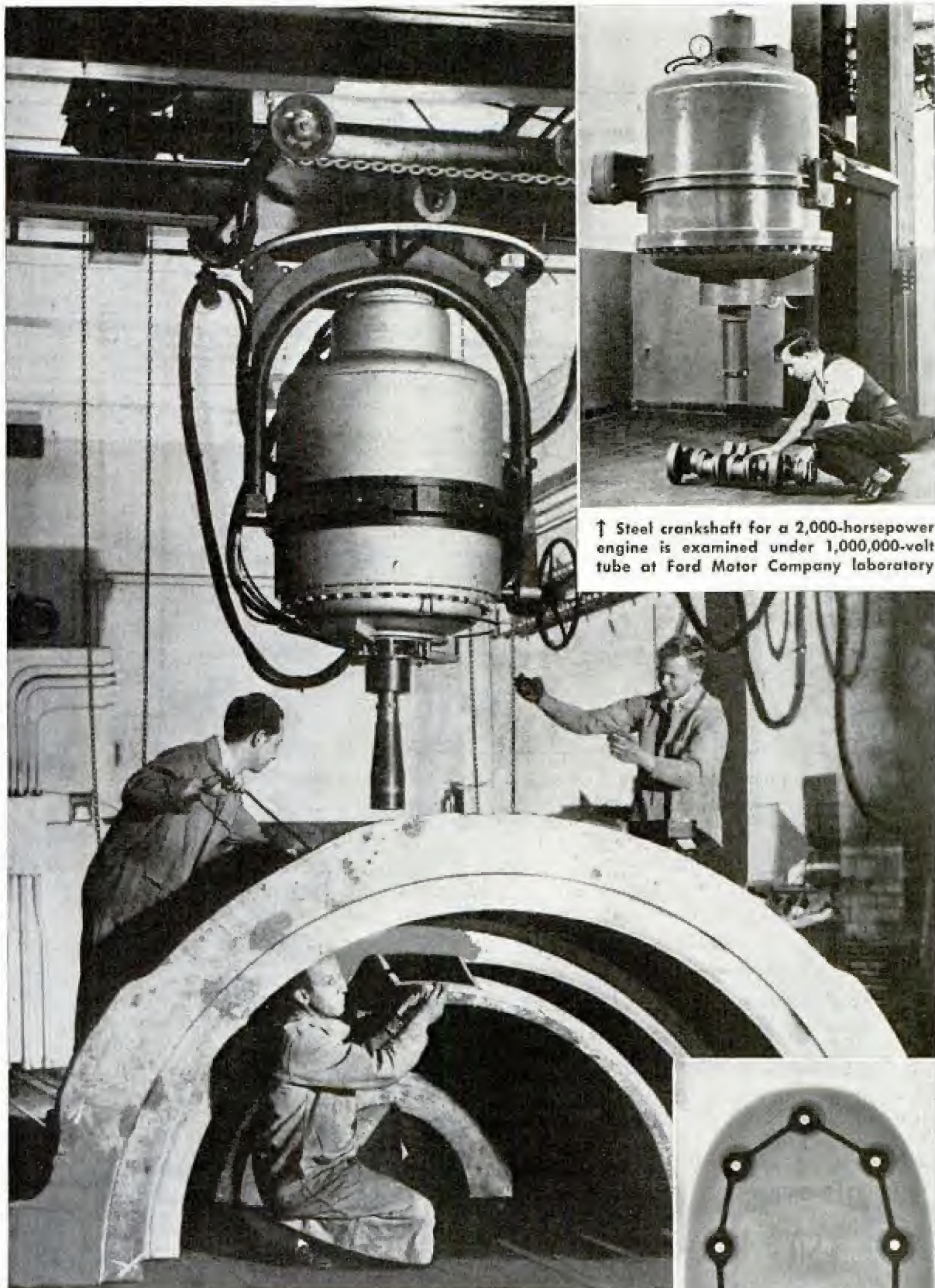
X-RAYS were born on the eve of the Spanish-American war, came of age medically in the hospitals back of World War battlefronts, and are finding their place industrially in the din of today's drive to forge an impregnable America. In the last few months a half dozen of the most potent X-ray machines yet devised, their million-volt electronic glance capable of peering through eight inches of steel, have been put to work in factories and foundries. While these giants of the breed are detecting deep-hidden flaws in battleship armor or high-pressure boiler drums or testing welds eight inches thick, smaller members of the family are turning their 5,000-volt seeing eyes upon thin aluminum sheet for fighter planes, producing micro-radiographs of metal structure and measuring stresses in magnesium, brass and aluminum by X-ray diffraction technique.

The range of usefulness for

(Continued to page 164)

POPULAR MECHANICS

21235



Above, one man checks the mounting height of tube above a huge casting, another directs positioning, third places film. Right, an X-ray picture checks the position of metal washers inside a molded rubber heel



21258

Fireboat Rides Trailer Ashore To Fight Flames Inland

Centre Street Here Just



Fireboat (top) on trailer, fighting shore fire, and (bottom) on the water

Ready to combat fires far ashore as well as on the water, a 16-foot fire tug is hoisted aboard a trailer for overland trips. In the water the boat is propelled by a jet from the fire hose stream. Being without a conventional propeller it operates in shallow water without injury. The motor is powerful enough to produce 800 gallons of water per minute.

tracts the mercaptans without affecting desirable qualities of the fuel. The method, available to the entire industry by a licensing agreement with the Universal Oil Products Company, involves the use of a mixture of water, caustic soda and methanol. In this process, which is simple and cheap, there is little or no loss of the solvent, and it may be used indefinitely.

21144

Holder for Chisels Absorbs Shock From Blows

For safety in holding chisels, punches and similar tools, a special holder permits the hand to be kept far enough from the hammer blows to prevent injury, and also takes up the shock so no vibration reaches the hand. It is a tubular piece housing a rubber-tipped piston that is actuated by a strong spring. This presses the chisel against an angular stop, so it may be held erect at all times. A trigger releases the spring tension for inserting or removing a chisel.



Spring grip for chisel keeps hand from danger zone

Odors Removed From Gasoline By Low-Cost Process

Sulphur compounds found in all gasoline, known to chemists as mercaptans, give off an odor so objectionable that the gasoline must be deodorized before it reaches the motorist. Until recently, this was done by merely converting the mercaptans into compounds which are odorless, but they were permitted to remain in the gasoline. However, as these mercaptans and odorless compounds were having a harmful effect on the effectiveness of ethyl fluid added to gasoline, a way to remove them was needed. Now the Atlantic Refining Company reveals discovery of a solvent which ex-

260 S Broad St
Philadelphia

M. E. Cunningham Co. 1756

Pittsburgh, Pa
Carson

Henley Engineering Service
Crosby St. Alton

21305 Cont: *Leland W. Roberts / Kent*
330 S. Lincoln St. / Ohio

Tiny 18-Cylinder Engine Spins 5-Foot Propeller

Fashioning all the tools himself and casting the parts needed from special aluminum and brass alloys, Lawrence H. Strayer of Kent, O., constructed an 18-cylinder engine in his home workshop. Since the engine, which weighs 24 pounds and develops seven horsepower, is too large and powerful for an ordinary model plane, the builder intends to test its ability to fly a glider. Patterned after the Wright Whirlwind, the engine is a double-bank, radial type, and is air cooled. The compact miniature power plant measures only eleven inches across and has a stroke of one and one-eighth inches. In testing the engine, the inventor connected it to a five-foot propeller which it was able to turn at 2,500 revolutions per minute.



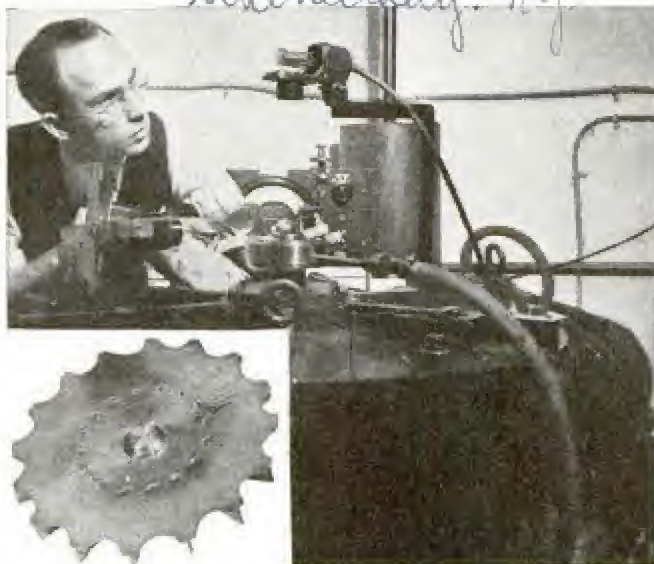
Model of 18-cylinder radial engine was built in home workshop

Metal Wheels Spin to Destruction in Test of Bomber Part

Safety in the operation of high-speed rotors used in superchargers of high-altitude bombing planes is the goal of experimenters at General Electric research laboratory, where heavy metal wheels are spun in a "vacuum bottle" until they fly apart. With virtually no air resistance to overcome, a five-pound turbine, driven by compressed air, can turn a 20-pound wheel

at speeds up to 1,000 revolutions per second. At that tremendous speed, every pound of weight on the rim of a wheel one foot in diameter exerts a centrifugal pull of more than 100 tons, and wheels often burst with the force of an explosion, throwing fragments, which may weigh several pounds, with as much energy as the projectile of a small naval gun. In order to

withstand such pounding, the vacuum chamber has massive steel walls, and it is sometimes lined with lead bricks to minimize damage to the fragments which are examined for information concerning the nature of the breaks. In making tests below the breaking point the rotor is coated with a brittle varnish that will crack at the points of stress. The cracks occur at right angles to the direction of the stress, and their number indicates the relative magnitude of the stresses.



Adjusting mechanism which includes mirrors and photocell to measure speed. Inset, varnished rotor after high-speed test

Science Service 11/15/41

Scheuchly, N.Y.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

Building the "LIBERTY" FLEET



29 7 4
Blocks supporting a new ship ready for side launching drop out of the way when a button is pressed

A riveter rams one home into the hull of a vessel



TWENTY years have elapsed since America built its last great merchant fleet and many new ideas about ship construction have been developed since.

This new knowledge is being applied to the hundreds of ships America is building today. Our new vessels will carry more cargo at faster speeds and use less fuel than the famous "Hog Islanders" that were built during the first world war.

Three hundred and twelve vessels of a new emergency cargo class have been ordered, and the chances are many hundreds more will be built before the greatest shipbuilding program in history ends. In addition to this and the vast construction program under way for the Navy, shipyards have expanded their ordinary "50 ships a year" schedule. In all, 759 merchant ships of 2,000 tons or over were under construction or order last summer. A construction rate of 5 million tons a year of seagoing ships is expected by 1943.

The emergency class, designated as EC "Liberty" ships, are trim vessels

2994 Capt. Thomas E. Himsogl, Jr.
3872 Franklin Ave., Los Angeles



designed for simplicity in construction and maintenance. They will be 441 feet long, of 10,500 dead-weight tons, with a speed in excess of 11 knots. Including gunners, each will carry a crew of 54. Defensive armament will include paravanes that are towed from the bows to ward off mines. Crew quarters are amidships instead of at one end, are insulated against heat and cold, and in some cases have forced ventilation. Stub masts not as tall as the radio pole over the deckhouse will be used for cargo handling. The ships will have watertight bulkheads, fire detection apparatus, and refrigeration apparatus.

The "Liberty" ships will be powered with 2,500-horsepower steam engines of triple-expansion reciprocating type. All auxiliary gear such as steering gear and cargo winches will be steam-operated. Old-fashioned in some respects, the engines are of advanced design

At a Long Beach shipyard a new ship splashes sideways into the sea. Beyond is a forest of oil-well derricks

This is the automatic seam welder which has to a great degree done away with riveting in ship construction



MARCH, 1942

U.S.

Maritime Information 51
Maritime Commission
Washington, D.C.



The newly launched "Agwiprince" is towed to fitting-out dock and a new keel is laid on the ways it left

and will be economical. They must be used because the country's turbine and Diesel manufacturers are already swamped with orders. All the machinery will be self-oiling. Oil fed boilers are to be insulated by casings inside of which incoming air for the fires is to be preheated.

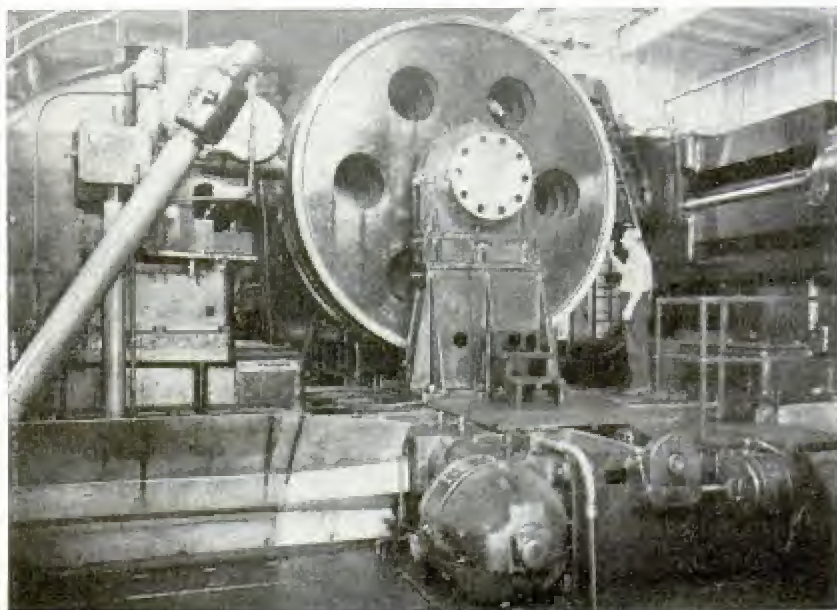
Two years or more are needed for building a ship in ordinary times. During the first world war some vessels were launched six months after their keels were laid, setting construction records that were thought never would be broken. Such records are too slow for us now and the EC ships will slide into blue water within three or four months after they begin to take shape.

During the last war prefabricated sections of ships were built in shops around the country, then shipped to the yards. This time, prebuilt sections are being assembled in shops adjacent to the ways, then lowered by crane into the ship.

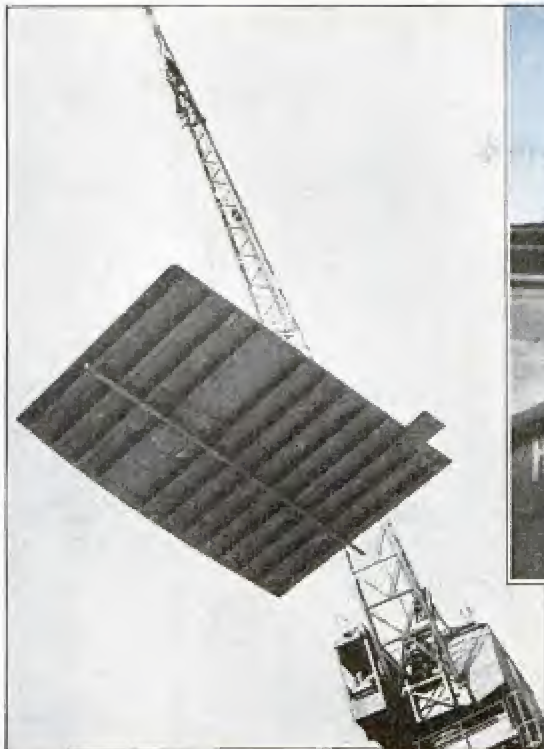
It used to require some 2 million rivets to build a ship; these added weight and drag to the structure. The Libertys will be virtually all-welded construction, reducing weight, adding to construction speed, eliminat-

ing projecting rivet heads and overlaps on the hull, and providing a hull that will bend under impact instead of tearing apart at rivet points.

Meanwhile, construction of scores of C-1, C-2, and C-3 cargo and cargo-passenger ships, as well as dozens of high speed tankers, has been speeded up. The C class vessels range from 7,500 to 12,500 deadweight tons, powered by Diesels or steam turbines, and are among the most efficient and economical vessels in the world. These ships are being custom-built for various trade routes. More time must be taken with them because such things as turbines and reduction gears, for instance, require months of painstaking manufacture.



Marine speed reduction gear being cut on large gear hobbing machine in General Electric plant



Above, a welder assembles a prefabricated part of a ship. Left, a crane moves a prefabricated section into position

A reduction gear set must have teeth machined to ten-thousandths of an inch because any defect would magnify itself, causing vibration in the propeller shaft. Gear teeth are cut in a special shop where the temperature is held close to 72 degrees F. The gears are not brought into this shop until they have been slowly cooled or warmed to the same temperature in an ante room. Even the temperature of the lubricating oil that feeds the cutting machines is controlled. The process of cutting a gear, which may take over 285 hours, must be continuous. An interrupted cut might ruin the gear.

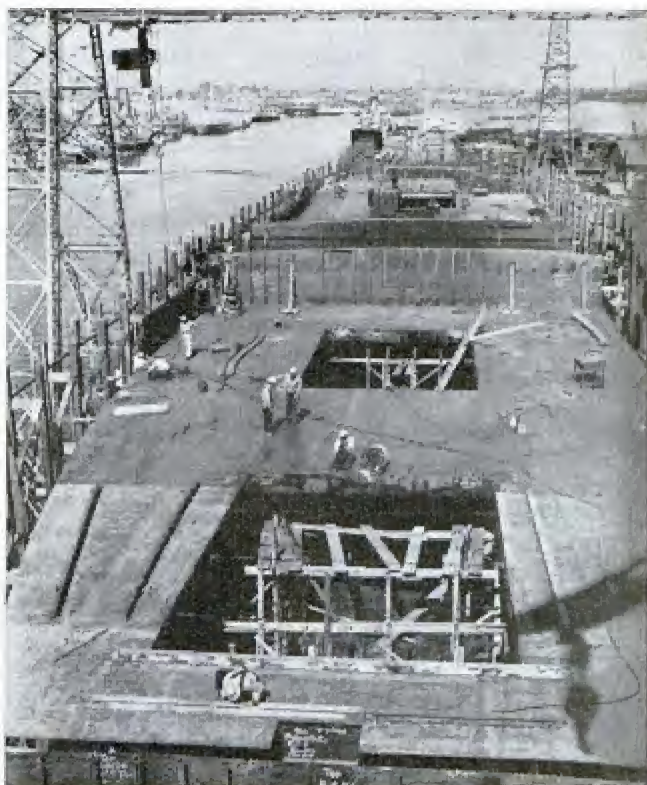
The C vessels have normal speeds of 14 to 16½ knots and are 30 to 50 percent faster than our first war-time fleet, yet have essentially the same operating costs.

The superiority of the modern ship is shown by a comparison of two recent voyages, one by the 20-year old "Crown City" and the other by the new "Challenge." Over the same route, from New York to Port Said, Bombay, Calcutta, and return, the "Challenge" left New York 26 days after her older rival. Both arrived back

home the same day. Operating costs were about the same and the "Challenge" carried 1,000 tons more cargo than the "Crown City."

To build this great fleet, new shipyards are being constructed on all three coasts. Work is being scattered among many small

(Continued to page 184)



Completing one of the lower decks of a new merchant vessel

21324

Rolling Sling for Injured Pet Permits Spine to Heal



Doggie sling carries all the weight so pet may walk about without risk of straining its fractured spine

A fractured spine does not stop "Lady," a Doberman pinscher, from tagging along on hikes over the sidewalks of Manhattan. Her mistress, Mrs. Andre Duvallon of New York City, has provided a sling, or cradle, to support the dog as it walks. Adjusted by ropes passing through pulleys at the top of a frame equipped with casters, the sling may be hoisted just high enough so Lady's feet barely touch the walk.

Sign Held on Glass by Vacuum Uses Cardboard Letters

Rubber suction cups hold a new window sign on the glass of show cases or display windows. The sign portion consists of a



Lettering sign, and, bottom, how it looks in window

Chicago 3-32
Michigan

long metal holder with tracks to receive letters and numerals cut from cardboard. It permits changing the message or position of the sign as often as desired.

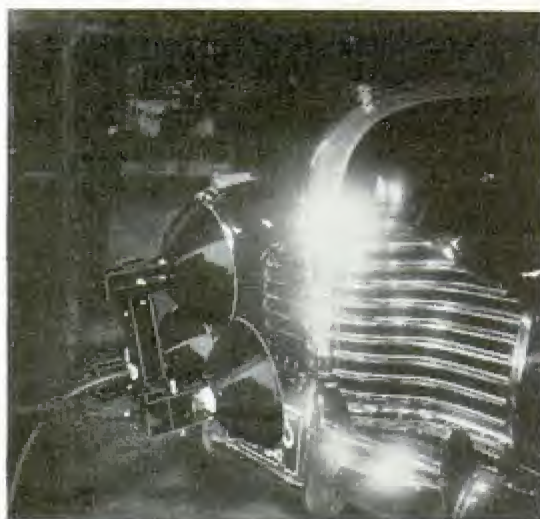
2983

Cause of Flat Railroad Wheels Ended by Brake Control

Sliding of railroad wheels when brakes are applied presents a twofold problem, since it lessens the braking effect and also flattens the wheels, which are expensive to repair. This difficulty has been solved on the Burlington's Twin Zephyrs by installing an electric brake control, developed by American Brake Shoe and Foundry company, that releases the wheel as soon as the brakes lock it. To accomplish this, electric relays automatically compare the speed at which associated pairs of wheels are rolling. When an abnormal difference occurs, as when one or both pairs of wheels may be sliding, the air brake pressure is reduced until the slipping wheel starts rolling at a speed equal to the others.

21313

Infrared Heat Focused on Auto Thaws Frozen Radiator



Heat rays from infrared lamps thaw frozen radiator

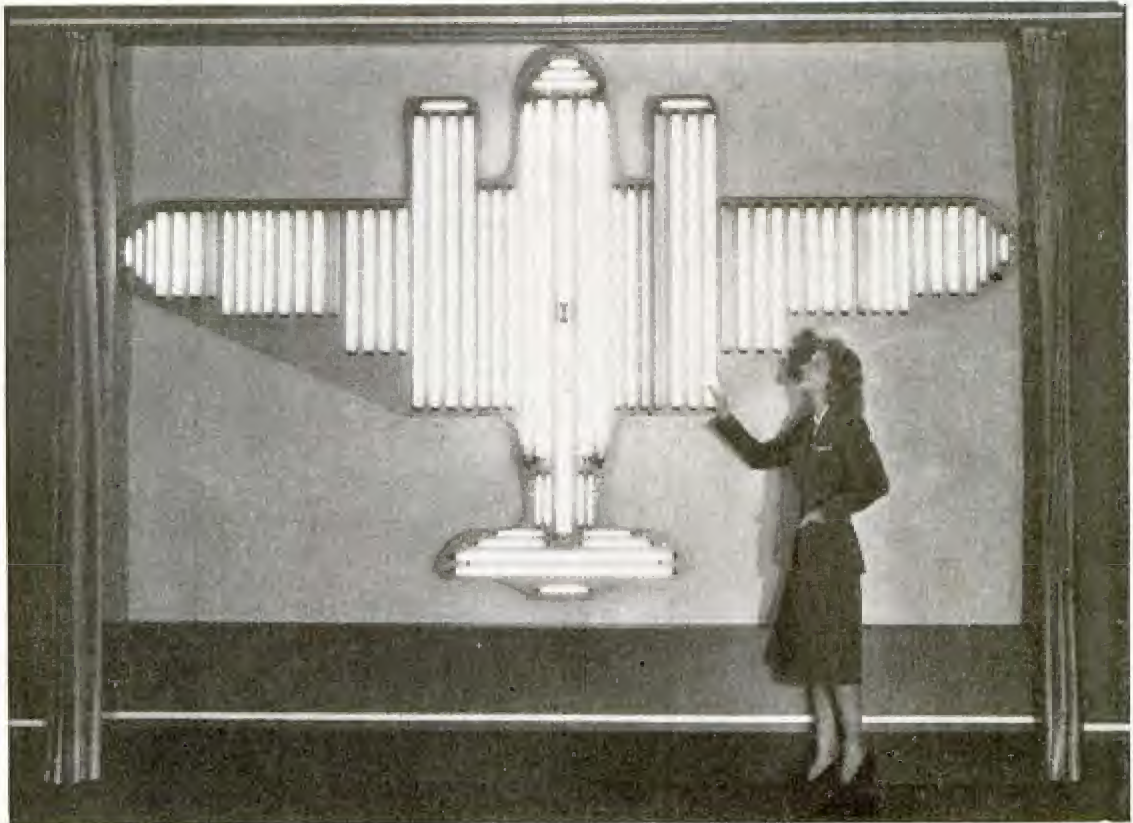
Heat radiating from three infrared lamps mounted on a special stand, is capable of quickly thawing out frozen radiators on autos, trucks and tractors. Since each lamp, backed with a gold-plated reflector, can be focused independently, the heat rays may be concentrated on a small area for thawing car heaters and water pump connections, warming oil and grease, or drying wet spark plugs and upholstery.

POPULAR MECHANICS
The Poplar Press
Steel Corp. Houston, Ohio

Red Chief Industries
2326 S. Michigan Chicago

21319. Cont. Office Road, 5424 Cornell
Chicago

Fluorescent Lamps Depict Bomber in Pageant



Spread out in the form of a bomber, this display shows 74 types of fluorescent lamps used by industry

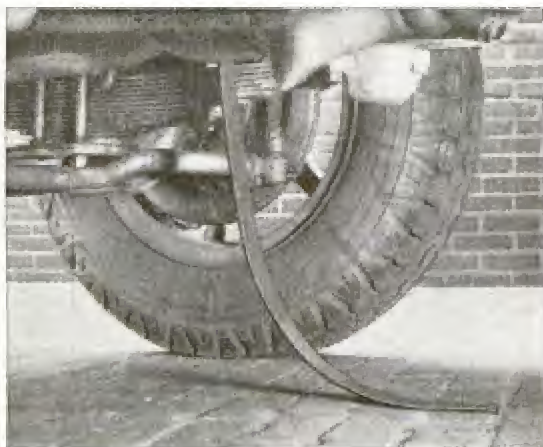
"Painted" with brilliantly colored bars of light, the figure of a twin-motored bomber is pictured by a novel display of fluorescent lamps in a war pageant. In the layout are 74 different types and sizes of lamps, mak-

ing approximately 125 feet of fluorescent tubing. The display, created by General Electric company, is a feature in the production, Wings of Vision for Defense, which will be exhibited in principal cities.

Silent "Static Drag" for Car Takes Place of Noisy Chain

Static accumulations in an automobile can be dissipated silently with a compound rubber drag now on the market. It is a

strap $1\frac{1}{2}$ by 30 inches fitted with an eyelet for bolting to a metallic underpart of the car. A good conductor of electricity, it drains electrical charges into the ground. Although a dry pavement is a poor "ground," the average car passes over enough railway tracks and manhole covers to get rid of static. Trucks and buses use steel chains to accomplish the same purpose, but because of their clanking noise, few passenger cars are so equipped. The new dissipator is light in weight and is said to have excellent wearing qualities.



Automobile drag made of compound rubber scrapes along pavement noiselessly, conducting accumulated static charges of electricity from car body into the ground

MARCH, 1942

Electric Service Supplies Co. 55
17th and Cambridge, Phila

TOMORROW'S PLANE TAKES SHAPE



D. R. Davis, designer of a new "family" of airfoils, with wind-tunnel model of fast "manta ray" fighter

NOT content with having built larger and probably faster airplanes than any other country, American aeronautical genius is buckling down to the job of beating its own world records.

Airplanes that will dive as fast as sound itself are on the drafting boards. Giant transports larger than the B-19 "hemisphere defender" are under construction. More important than any such single project are the multitudes of refinements that are making flight safer and more efficient than ever before.

Progress in high-speed design is now a military secret, although several concerns are working on interceptor airplanes that will fly well in excess of the 400-miles-per-hour-plus top speeds of present pursuit planes. Much of the secret work the factories are now doing will be available for commercial aircraft in the future.

Next spring Lockheed expects to test fly



Landing map of flight recorder enables ground watcher to guide oncoming plane directly to the airport

Spinner starts plane wheel rolling before it lands



POPULAR MECHANICS

Roberts Aircraft Engineering Co.
203 N. Lake, Burbank, Cal.

2944.



Spot welding sub-assembly of plane

the first of a group of "Constellation" transports it is building for TWA and Pan American. These giant air liners will carry 64 passengers in regular service and will have a loaded weight of 83 tons. Their speed will be in the 300 mile per hour range, with a 4,000 mile cruising radius, and they are designed to operate at 30,000 feet altitude. Both the cabins and engines will be supercharged. The giants have been designed by TWA engineers and by Howard Hughes' engineering staff.

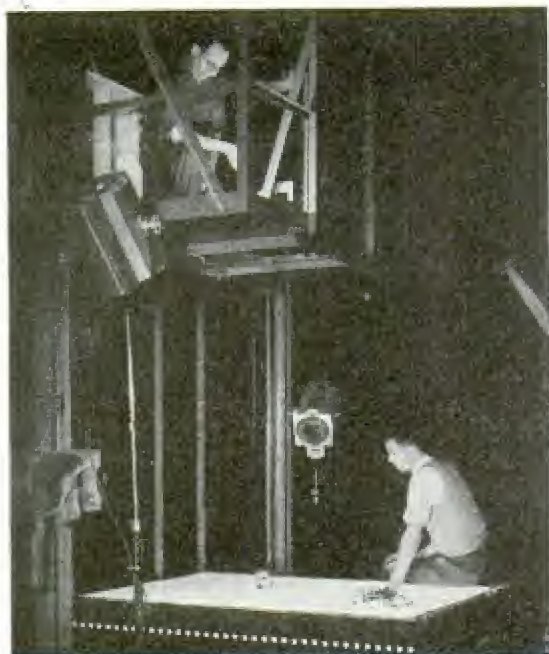
One development that promises to influence future design is the so-called Davis wing now being used on Consolidated bombers. This particular wing shape adds some 15 percent to an airplane's efficiency. In the case of a 100,000-pound transport in which the airplane weighs 50,000 pounds and the remaining 50,000 pounds is equally divided between fuel and pay load, an additional 15,000 pounds of carrying capacity are provided by the wing. This permits the plane to carry 40,000 pounds of cargo instead of 25,000 pounds, a gain of 60 percent without sacrifice of speed or range and with no increase of horsepower. Or with the original cargo a 60 percent increase in fuel capacity may be had.



These directional fading coils help ground watcher locate plane in air

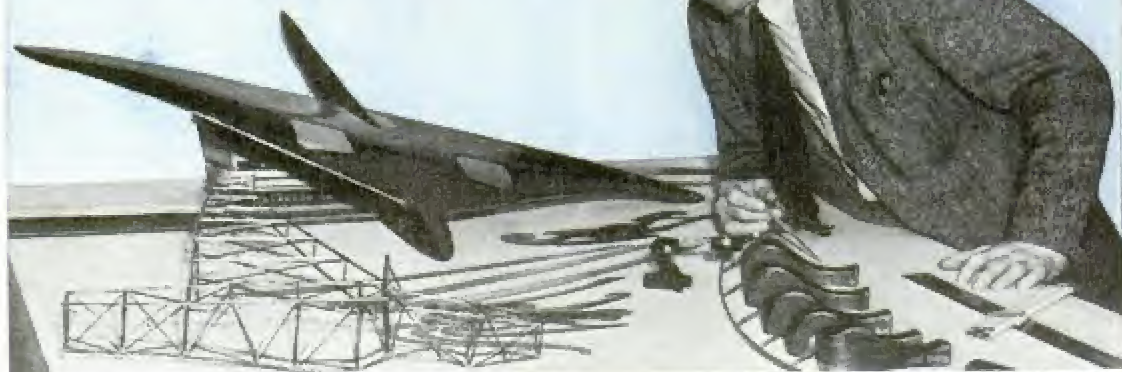
Developed by D. R. Davis, the long-range wing is one of a family of curves that may be laid out from an original formula that expresses the most efficient mechanical action. In effect the new wing shapes reduce drag, to some extent taking the brakes off airfoil sections. Ordinarily when a fuselage and tail group are attached to a wing the drag of the whole structure becomes twice the drag of the wing alone. With the Davis airfoil sections an increase of only 40 percent in drag occurs.

One of the new wing curves, called the



The vertical camera above has been adapted for making photo templates in airplane construction

Below, an aeronautical designer works out a new airfoil curve from intricate mathematical formula



Manta because of its resemblance to the manta ray, is being used in the building of a new fighter airplane that is characterized by a single low-horsepower engine and yet carries heavy armament at high speed and can climb to extreme heights.

Flight recorders such as are being used in England to locate and track invading planes promise to become a useful safety measure in the future. Improvements are being made to the Spitz flight recorder, an apparatus developed in the United States and one that works partly on different

principles from the British type. The recorder reveals to a watcher on the ground the distance to the airplane he is tracking, the direction it is traveling, and its speed. The plane's location appears as a tiny dot of light on a map, allowing the watcher to radio the pilot the position of his plane and, in the event that he is lost, what courses he should steer.

The principles of the flight recorder may also be applied to determining the positions of fog-bound ships, for locating submarines under water, and even for learning the exact locations of all the police radio cars in a large city.

The passenger transports that we watch in the air today seem to be the same airplanes as were flying two and three years ago, and so they are, in external appear-



Behind the strip map of a flight recorder is this bewildering maze of electrical wiring

2944

21276

ance. Actually scores of minor improvements have been made to them with the result that horsepower has been going up, operating efficiency has been increased, and in particular, air travel has been made safer. Airway radio beacons and markers have been changed to ultra-high frequencies, assuring more reliable operation.

To reduce the glare from lighted instrument panels, ultraviolet "black light" is used to fluoresce radioactive paint with which the instruments are painted. Maps and charts are being treated chemically for similar results. Transparent plastic wing-tip sections, lighted inside, are being tested as a replacement for ordinary wing-tip lights, now that airplane speeds are rising to a point where the usual red and green running lights need greater range.

Fast landings by heavy transports impose terrific loads on tires, bearings, and landing gear. Better control during landings, as well as reduction of wear and tear, is the purpose of a new wheel spinner that starts the landing wheels rotating at 40



Engines and nacelles being tested in a wind tunnel

miles per hour before they touch ground. A small hydraulic motor inside the wheel builds up tire speed in ten seconds.

Two years ago the plastic airplane was being hailed as an important development because it seemed that such planes could be built faster and cheaper. The talk died, but since then much work has been done on them. One new system forms the whole wing skin as a unit that slips over the rib assembly like a glove. Molding the units into shape by means of hot water pressing against rubber blankets is one new system that may bring construction costs down. The method permits positive control of both heat and pressure.

Door Arch Is Easy to Shape With Flexible Bead



Fitting plaster bead over doorway to form an arch

Shaping plastered arches over doorways and windows can be simplified with a bead made of flexible material. The bead fits over the door corners and remains rigid except at points where the flange may be slit with shears for bending. It can be bent by hand to the desired shape. According to the manufacturer, the bead provides an excellent key for plaster and saves up to one-half the usual material and labor costs.

Soldering Kit in 'Nutshell' Splices Electric Wire Connections

Electric wires may be spliced quickly with a self-contained soldering unit that holds enough solder for one connection and generates its own heat. Solder and flux are sealed within a waterproof shell. It is only necessary to push the wires into the shell, and ignite it with a match. Heat from the burning shell flows the solder into the splice, then the burned shell drops off, leaving a cleanly soldered connection.



Slip shell on wires, light it, and splice is soldered

Jiggers, due 215 W. Collins

Robertson, C. 203 N. Lake

National Engineering & Buffalo, N.Y. 1921 Delaware.

Chewy

L1300

Coupled Table-and-Chair Holds Lamp and Books



Combined table-and-chair has a shelf to hold books

Built as an inseparable unit, a combination table and upholstered chair is connected rigidly in a convenient range for reading. The chair and table may be used in the living room to hold a reading lamp and books or magazines, in a hallway or outer office as a reception piece, or may serve as a telephone set with space for the phone, books and writing material.

Dog Carries His "Card" in Tube Fastened to His Collar

Dog owners who want to assure safe return of lost pets can fasten a new identification



Dog's identification is rolled up and sealed in tube

fication tube to the dog's collar. Made of nickel-plated steel, it withstands battering and seals the contents against rain. A stranger finding the dog can learn its master's identity by unscrewing the tube and removing a slip of paper with his name, address and telephone number. The tube is equipped with an eyelet for convenience in securing it to the collar.

Windows Built Into Glass Walls With Transparent Blocks

Transparent glass blocks are now available for use as windows in glass buildings whose walls only admit the penetration of light. Although they do not give clear-cut vision, the new "window blocks" permit a general view of traffic and people in motion out-of-doors, thus dispelling that "shut-in" feeling sometimes experienced by those within a glass building which per-



Window in glass building made of transparent blocks mits no outside vision. Easily installed without need of special frames, both in glass walls and walls of other material, the transparent blocks contain a dead-air space for insulation.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

*L 1308. Robert H. Gargner, Manager
South Euclid, Ohio
Four in Hand brand*

Space-Saving Chairs May Be Nested Into One

Four matching chairs that telescope one over the other into a unit may be separated for use at a bridge table when guests arrive. Being of the same height, the chairs may be placed side by side for use as sectional pieces. A metal molding all around the bottom permits the chairs to be glided with ease. Upholstering over the entire chair is applied in the form of a slip cover, fastened underneath by the molding. After guests leave, the four chairs are nested, forming one piece. They are also furnished in sets of two.

Four chairs, nesting one inside the other, are all of the same height so they may be used separately or set side-by-side, as in the inset, to form sectional pieces



"Smoke Rings" Shot From a Gun May Rid Cities of Soot

Engineers are blowing invisible rings of air, like the smoke rings blown by a cigar smoker, in a unique experiment that may some day rid cities of the factory smoke nuisance. This research project is under way at the Westinghouse laboratories.

These air rings, shot from a "machine gun," whirl out with enough velocity to extinguish a candle flame several feet away. The gun discharges rings at two per second when its back is tapped with a hammer. The engineers are seeking a method of shooting factory smoke high into the sky and thus keep clear the air over industrial centers.



Fast whirling rings of air, shot from gun in background, snuff out candle flames. Idea some day may be applied to city smoke

"Puff" From Air Whistle Aids Navigation

For safety where boat traffic is heavy, a whistle that gives both an audible and visible signal has been introduced by John Hays Hammond, inventor. When sounded, the whistle emits a long, dense, white plume that remains in view long after the blast dies away. The cloud, consisting of finely ground aluminum stearate, is ejected by air pressure from a metal cylinder that can be attached to any air whistle. According to the inventor, the visible signal is an aid to navigation, since it can be traced to its source when many whistles are blowing at the same time.

21262 Com. Cy La Tour, 357
Raymond Ave. Pasadena, Calif

SHARK KILLERS' CLUB

The Bottom Scratchers
San Diego, Calif



Still wearing their flipper fins, and with their face plates lifted, two members of a unique San Diego swimmers' club come in from a sea hunt with fish that will form part of a dish of "Chapine," a thick chowder made of filets of various fish, octopus, and abalone meat pounded wafer-thin; this is boiled in highly seasoned tomatoes and served in abalone shells. Only five men have qualified for this shark killers' club by swimming a half mile out into the Pacific, diving 35 feet to bring up an abalone shell in each hand, and later bringing to the surface, barehanded, a shark not under four feet long. No knives, or spears are permitted in this test. On regular shark hunts they carry three-pronged spears and a knife

Three of the five club members, above, bring in their morning catch of two sharks and several smaller fish. Often they paddle the surfboard for beyond the breakers, then dive deep for big game

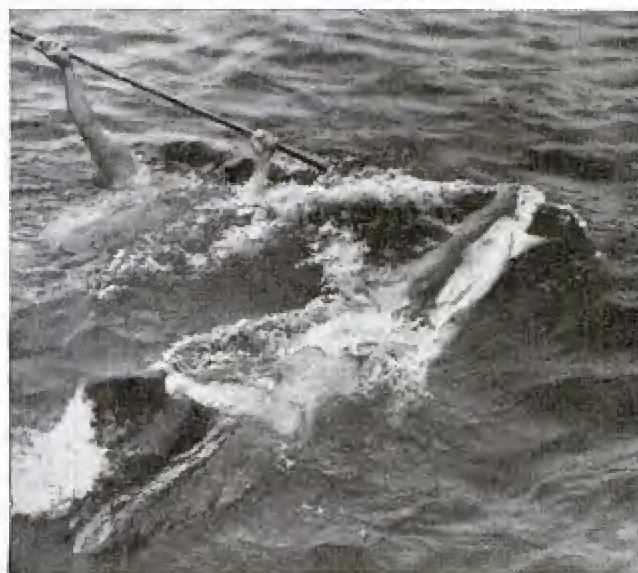


Above, one of the sportsmen straddles a surfboard carrying a catch of abalones. The diver swims to the floor of the sea and pries the shells loose from the rocks with a blunt knife. At left, notice the knife hanging from wristlet. On one occasion one of the men became "handcuffed" on the bottom when his knife was wedged between two rocks; by a desperate backward lunge with feet braced against the rocks he was able to break the line and escape. In another adventure the line from a spear was wound around a diver's ankle and a big shark towed him deep until he was able to whip out his knife and sever the tangled line

Islen are
organizing
club



Harpooned by one man, a shark fights to get away just as a fellow member of the club—churning the water with his rubber fins—rushes up to get in on the kill. One member has two great tiger sharks to his credit, killed in a furious battle off the Mexican coast. The 14-foot spears have flexible shafts



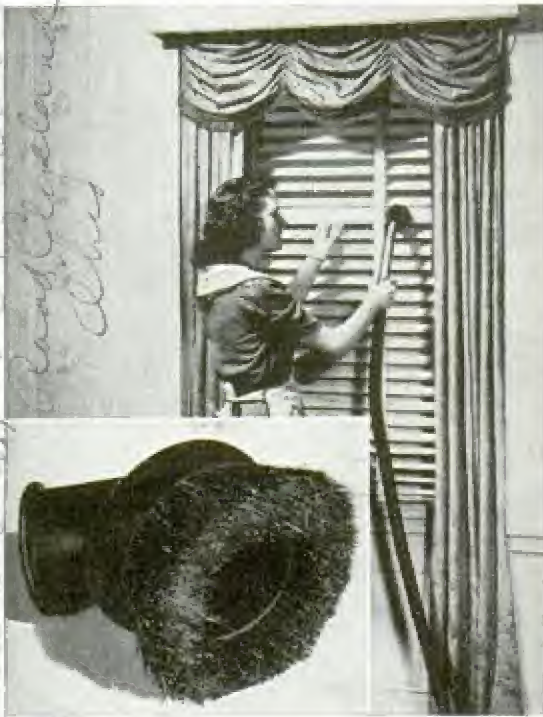
The fight is on! A shark, six feet or more long, has been harpooned by one swimmer while the other is sinking his knife into a vital spot as the great fish thrashes in an effort to shake free. The score isn't always in favor of the men, for sometimes the sharks tear the fingers and flesh of their attackers

Slashed from beneath with one of those razor-sharp knives, the shark at right was out of the battle quickly. These swimmers are so adept at underwater work that they are sometimes called on to free ship propellers which have been snarled by chains or cables; they succeed where mechanical devices fail



21303

Brush for Venetian Blinds Dusts Difficult Corners



Curved mounting helps reach all corners with brush

Fitting any vacuum sweeper, a small round brush aids in removing dust from venetian blinds. The rubber housing of the brush slips over the nozzle of the vacuum sweeper, and the tilted neck presents the brush at a proper angle for dusting overhead surfaces.

21315

"Squeezed" Food Saves Space In Shipping to War Zone

War-time shipping, requiring the movement of large quantities of food to Britain, poses the problem of "squeezing" great masses of supplies into a small space. Removing water from some products is one method. For instance, 200,000,000 pounds of skim milk were dried before loading. Eggs may be shipped in like manner, and both the dried eggs and milk are returned to useable form by replacing the water, although bakers use part of the food in dried form. One shipment of 150,000,000 dozen eggs was concentrated to a fraction of the natural shell bulk by breaking the eggs into metal cans in which they were sealed and frozen. They needed merely to be thawed for use. Orange juice also is subjected to the squeezing process. Con-

centrated to about seven times normal strength by removal of water, 1,000,000 gallons were reduced to 180,000 gallons of thick, sirupy liquid. Much of this went to Britain where the addition of water restored it to palatable orange juice.

21288

Folding Trailer Built Into Auto Can Be Stowed in Trunk

Small enough to slide into the trunk compartment of an automobile, a built-in folding trailer can be pulled out and towed whenever needed. A swiveling wheel, attached to the trailer body by a hinge, can be swung downward and locked in running position, the roomy tray tripling the luggage capacity of the car. Equipped with tail-light and reflector, the trailer slides in and out of the trunk on two slotted rails bolted to the floor.



Sliding trailer from trunk (top), and ready to go

POPULAR MECHANICS

A. S. M. 236

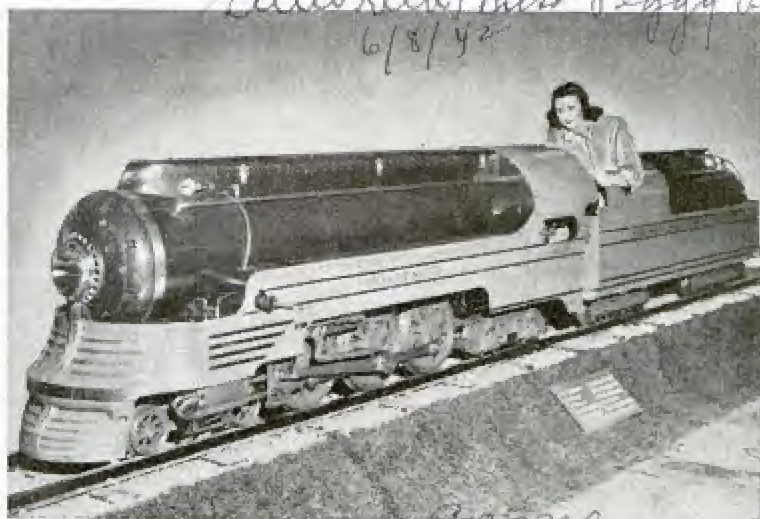
Buena Park Calif

rept. of agriculture. Release 11.12.22

21309. Built by Albert J. Wagner & Son.
Plainville, Illinois
Letter sent Mrs. Peggy Barr
6/8/42

Model Streamliner Runs 20 Miles in One Hour

Built to scale, a 20-foot working model of a streamline locomotive develops 40 horsepower at 150 pounds of steam pressure. It is a copy of the engine that hauls one of Chicago and North Western Railway's crack trains, the Challenger, between Chicago and the Pacific coast. With two bushels of coal for fuel, it can run 20 miles in one hour. It has 4 by 5-inch cylinders, 14-inch drivers, a 14-inch gauge, and weighs 2½ tons.



Miniature streamline locomotive can run 20 miles on two bushels of coal

21312

Typewriter With Variable Type Speeds Defense Plans



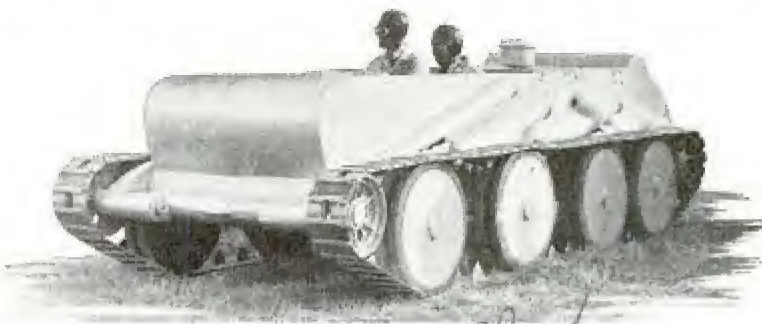
Lettering huge defense plans, which is usually done by hand, can be performed faster with a writing machine, operated like a typewriter. It is equipped with variable type of many fonts, easily changed to suit the job. With this typewriter it is possible to letter in half a day a set of drawings which would require four to six days of work by hand. The machine handles paper up to 12 feet long and six feet wide.

Typewriter for lettering drawings accommodates tracing cloth or paper 12 feet long and six feet wide. Many different type faces are available and change from one to another to fit each case is made quickly

21370.

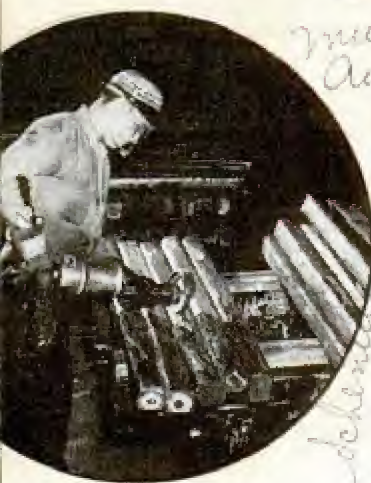
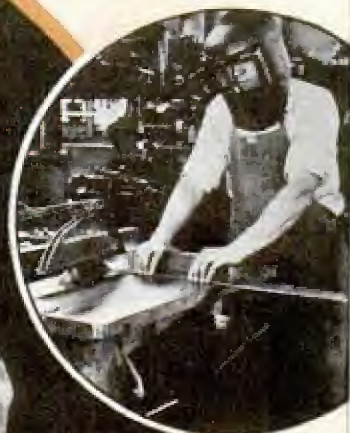
75-Mile-an-Hour "Tank Destroyer" Packs a 75-Millimeter Cannon

Capable of transporting a 75-millimeter gun at 75 miles per hour, a new streamline war monster is called a "tank destroyer" by the inventor, William Bigley of Hoboken, N. J. Eight wheels turn the mobile fighter's tracks. Its structure follows the basic design of the tank invented by J. Walter Christie.



Track-laying "tank destroyer," equipped with an airplane engine capable of driving it at 75 miles an hour, is designed to carry a 75-mm. cannon

The BATTLE for SAFETY



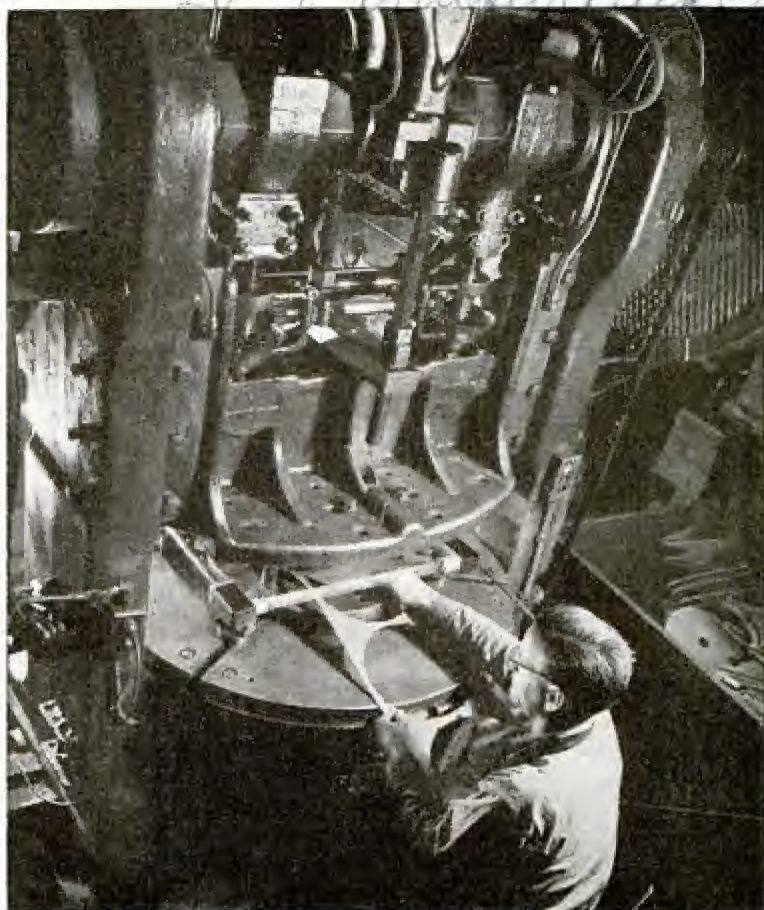
Millions of industrial workers are fighting a battle for safety; for every worker killed or injured is a war casualty. In the center, an American Airlines welder works behind a face protector. Left, top to bottom: General Electric welder wears ventilated helmet; safety mask, marred by accident, saved Lockheed Aircraft man from serious injury; transparent mask guards eyes while grinding. At right, top to bottom: electric precipitator tests purity of air around welder; face guard with laminated glass; pipeline repair man wearing canister gas mask; welder's helmet stops flying particles, reduces glare.

2943
 LONG before the shooting war began, the casualty lists were mounting.

American factories are America's first line of defense, and throughout the vast industrial machine soldiers with tools were dying by thousands, being maimed and disabled by more thousands, in a "blitzkrieg" led by General Carelessness. Production was mounting swiftly, but the accident toll was swelling at a higher rate.

Industrial safety experts and government men, alarmed by the loss of men and man-hours, got busy. They found that while general employment increased only two to three percent in 1940, industrial deaths jumped ten percent from 15,500 to 17,000. In 1941, fatalities may have reached above 20,000.

With millions of green



Schottroler Westinghouse
 Electric eye stops giant stamping machine as operator's hand reaches in

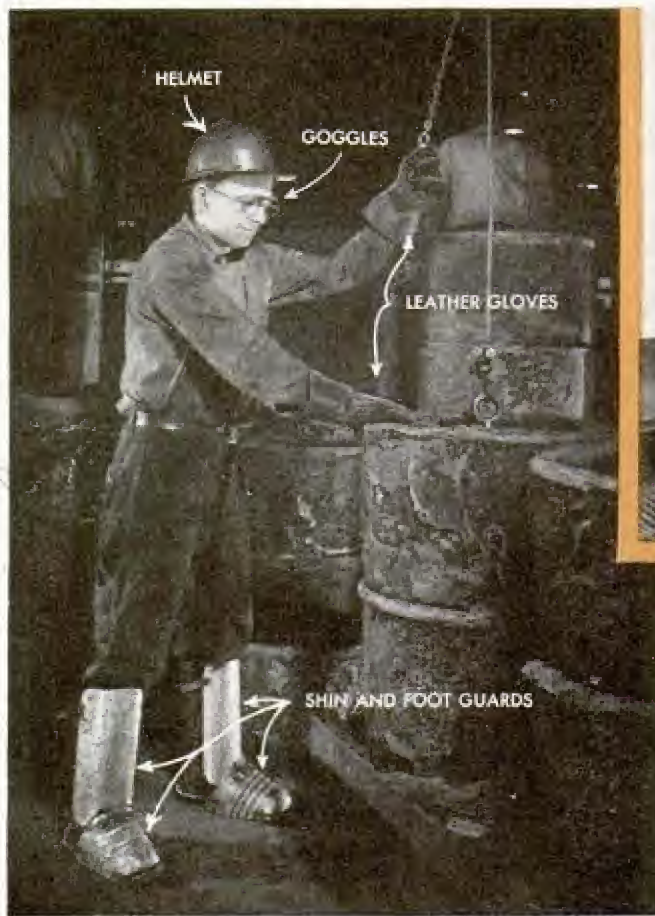
Flexible wire cords attached to wristlets of Bethlehem Steel worker shut off trimmer if his hands are in danger

Taking off respirator after visit to dust chamber, this man shows how well he was protected

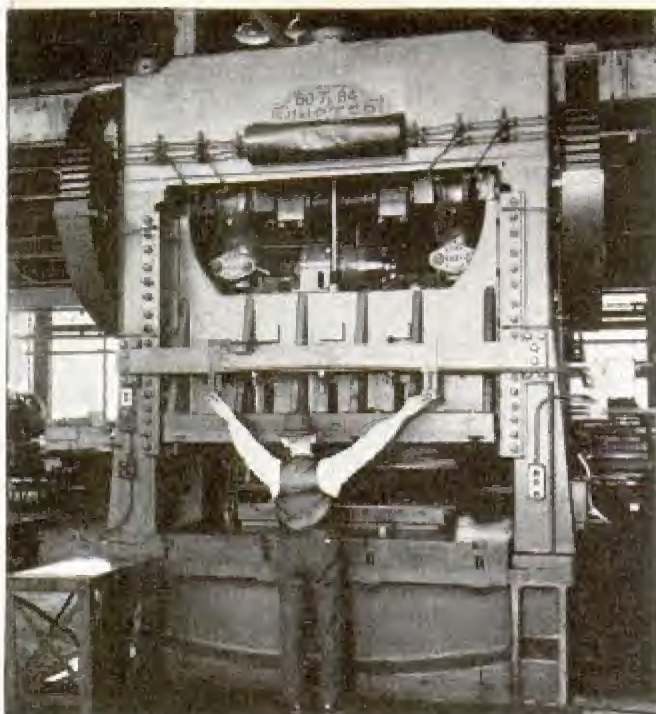


2043

Es & Schenckel



Handling hot metal is a hazardous job, but the Crane Company worker above is well protected. Below, for safety's sake a giant press in the Westinghouse plant is built so that workman must use two hands to operate it



Helmet, apron, shin guards, gloves and steel-capped shoes protect a sand blaster

workers added to payrolls, all more or less unfamiliar with shop and plant routine, with manufacturing programs speeded up, with many "rusty" old hands recalled from retirement and with tiring overtime hours the rule, the accident toll has appreciably slowed the country's arming program.

But the tide of the battle for safety is believed to have been turned, thanks to the use of scientific and mechanical safety devices plus an intensive campaign of education directed at the executives of small, "mushroom" defense plants. The larger corporations are not responsible for the sharp increase in accidents. Because of never-ceasing safety drives and ingenious protective measures, their accident figures have shown a steady decrease.

The average citizen who seldom sees the interior of a factory would mistake many modern workmen for warriors from Mars, equipped as they are with masks, respirators, goggles and face shields, head guards, Neoprene clothing, rubber aprons, metal capped shoes and asbestos outfits.

Bethlehem Steel protects open hearth men with asbestos clothing; trimming machine operators have flexible cords attached to

POPULAR MECHANICS

Bethlehem, Pa

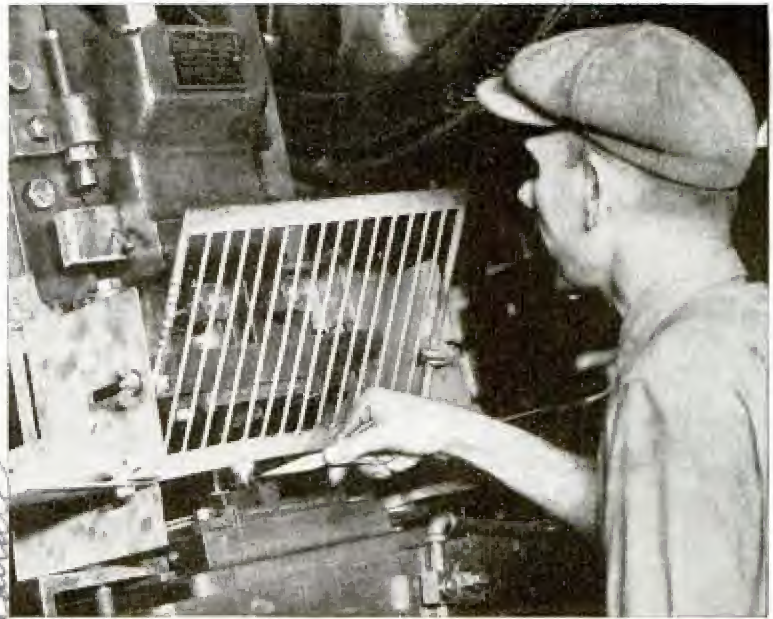
Manufactured by the American Iron and Steel Institute

2943
Fingers are saved from mangling by this guard → on a big punch press

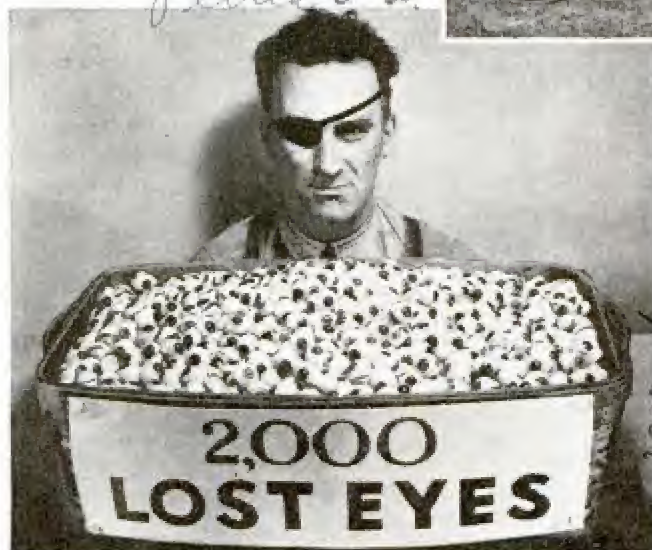
wristlets, and if a man's hand advances into the danger zone, the cord tightens and pulls a switch, stopping the trimmer. American Airlines has installed artificial waterfalls in its shops to eliminate dust and anti-corrosion spray. At a Westinghouse plant, electric eye mechanisms spot a welder's hand when he reaches into a giant stamping machine and stop it as the light beam is broken.

Jones and Laughlin Steel Company spent \$40,000 extra on a new building so that a 15-inch clearance could be left between overhead electric cranes and the building columns. The cranes are also provided with extra brakes on the jack shafts and miniature red and green traffic lights automatically tell whether the operator is in his cab. Caterpillar Tractor Company uses ventilated

It would take 2,000 artificial eyes to replace those lost every year in accidents, mostly avoidable



Here is a safe device for handling heavy tanks of gas at a steel plant



work benches from which dustladen air is pulled down through a grill into filters; fire blankets are at hand to wrap around a man whose clothing is ablaze.

General Electric lost only one man by accident during 1940, despite the rising national trend. This man broke a leg falling from a ladder and died of pneumonia. Westinghouse had the lowest accident rate in the company's history. General Motors established a safety record in its 89 plants with a lost-time accident record of only 3.43 for every million hours worked, and one plant has

(Continued to page 173)

Portable Fluorescent Lamp Encased in Plastic Tube

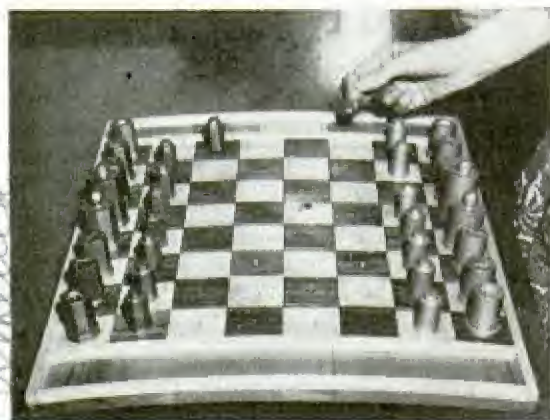


Portable lamp saves time in airplane assembly line

Production of defense material is aided by the introduction of a portable fluorescent light that the workman can carry to illuminate dark corners during both day and night shifts. Enclosed in a tube of transparent Lucite, durable and light in weight, a low-wattage lamp emits a spherical light that eliminates shadows.

Chess Game for Blind Requires Only a Sense of Touch

Only a sense of touch is needed to play a new chess set designed to make the lot of the blind easier. Black squares are raised, white depressed, and all men have

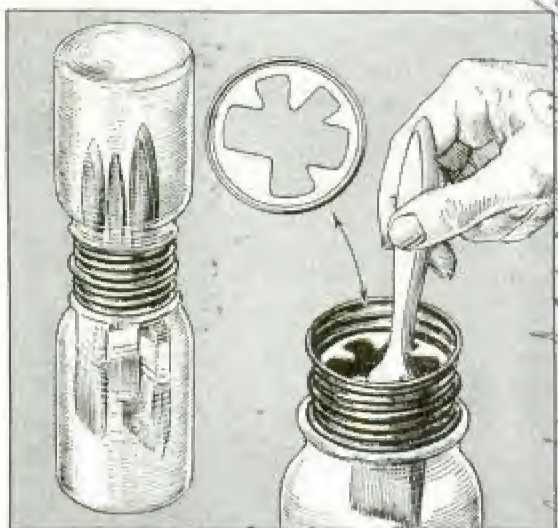


The blind recognize chessmen by distinctive shapes

distinctive tops for quick recognition. In each square there is a drilled hole, and all chessmen are fitted with pegs at the bottom so they will not topple out of position when touched. The white men are turned, while the black are octagonal. The rook has a depression at the top; the knight has an "L," right hand for the queen side and left hand for the king side; the bishop has a cross, the queen has a round ball on top, the king a beveled button, and the pawns have plain buttons. As soon as the blind players have a knowledge of the game and a tactile recognition of the men, they learn to play about as well as sighted persons, running their hands across the tops of the men constantly to familiarize themselves with relative positions.

Jars Sealed End to End by Holder Help Preserve Paint Brushes

Paint brushes can be preserved in an airtight container made by joining two Mason jars with the aid of a special two-

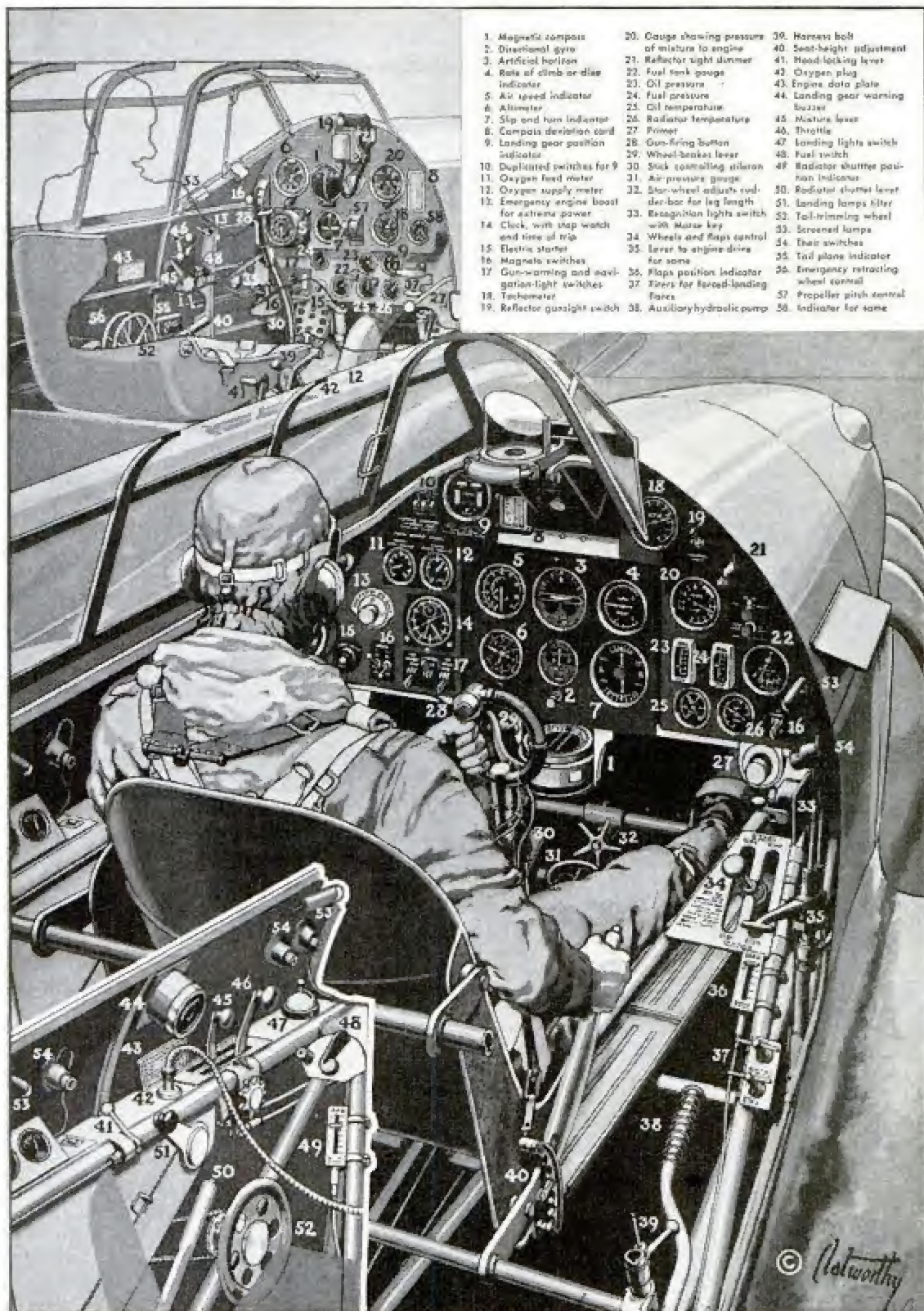


Paint brushes sealed in jars by special screw cap

way cap now on the market. At the center of the cap is a metal disk having slots through which several brushes may be suspended into the lower jar partly filled with linseed oil or other brush-preserving solution. When the second jar is inverted and screwed tightly into the upper part of the cap, the assembly makes a holder into which air cannot enter.

¶ To learn where to buy commercial products described in these pages, see the index.

Fighter Plane's Cockpit Is a Maze of Controls



To the uninitiated, the cockpit of a modern fighter plane is a bewildering maze of instruments and controls; only after months of training are the pilot's reactions so automatic that he can fight as well as fly. Here is the cockpit of a British Hurricane; above it, that of a German Messerschmitt

134 Fleet St. 71
London E.C.4. Eng

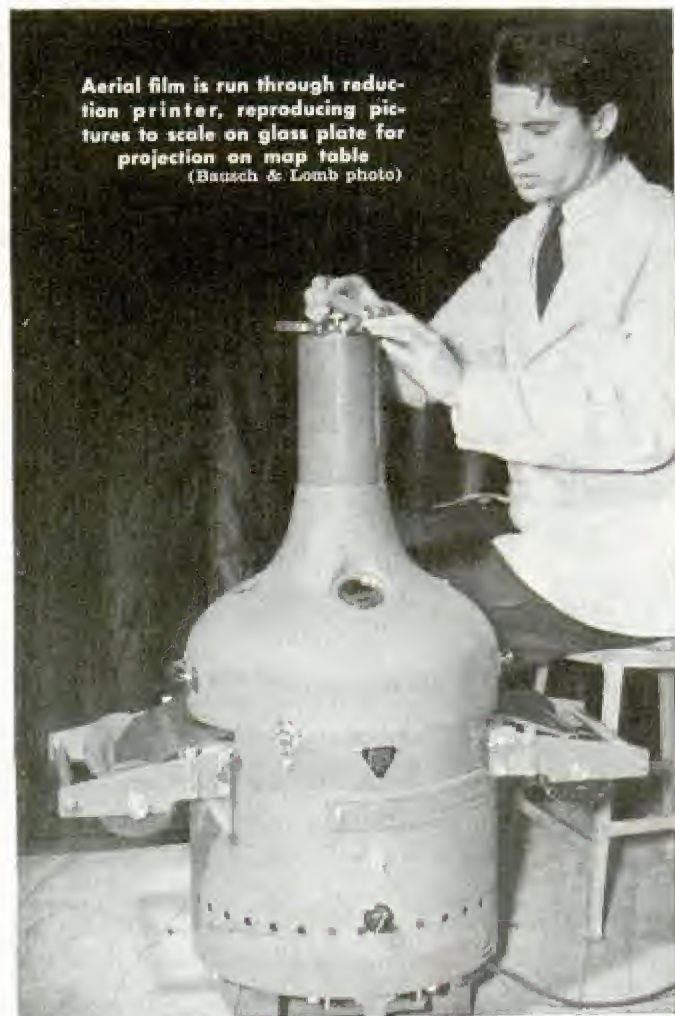
2963 Cont. Allen Warren Elliott
3436 33rd Street

Observing the area of fire with the battery commander telescope during anti-aircraft target practice at Fort Tilden, N. Y.



The GLASS "EYES" that give

Aerial film is run through reduction printer, reproducing pictures to scale on glass plate for projection on map table
(Bausch & Lomb photo)



SEVEN miles above the earth aerial cameras are plotting the terrain of a military engagement. Hollywood is on the threshold of a revolution wrought by new methods of using lenses. New spectacles are freeing the color-blind motorist from danger. The greatest lens the world has ever conceived will soon be ready to reach into uncharted spaces of the universe.

Centuries ago men learned to bend light rays with glass, and few single factors have influenced the course of civilization so much as the lens. Yet men learned slowly how to put it to work. Spectacle lenses arrived about 1290, then nearly 330 years passed before a Dutch spectacle maker evolved the telescope.

In the last few generations remarkable advances have been achieved in sight, photography, motion pictures, lighting, radio, television, medicine, biology, bacteriology, metallurgy and astronomy. Today the rate of progress is phenomenal.

In New York, experimenters led by Dr. Alfred N. Goldsmith,



← "Closeup" lenses of "sculptor's glasses" are raised when they are being used for distant view

Patient with aniseikonia tilts table with white balls when told to level it; his eyes do not see alike
(American Optical Co.)



MAN SUPER-VISION

known for his radio and television discoveries, have developed a new use of lenses which will revolutionize movies when Hollywood adopts the method, which is not likely to be long because it solves one of the most baffling puzzles that has confronted the moving picture industry.

One basic difference between watching a stage play and a movie is that your eye has no fixed focus and can follow a performer around the stage, keeping him always in clear view. Compared to the eye, however, the motion picture camera has been a crippled organ of vision because it has a fixed, or limited focus. For this reason, unless the camera is moved with the performer, he fades into a blur as he steps out of focus. That is the reason you have had to put up with annoying "close-ups" followed by "long shots" which break the continuity. They are merely clumsy subterfuges which hide the weakness of the camera which cannot give you both at once.

Soon you will be able to follow



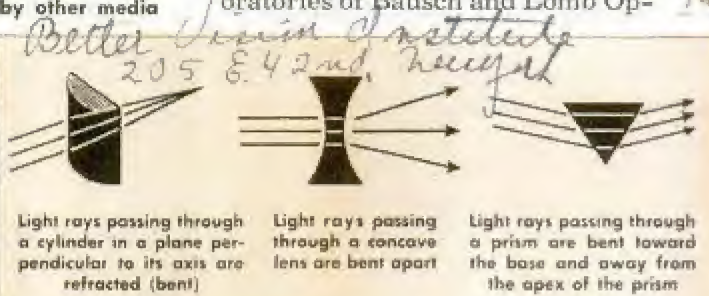
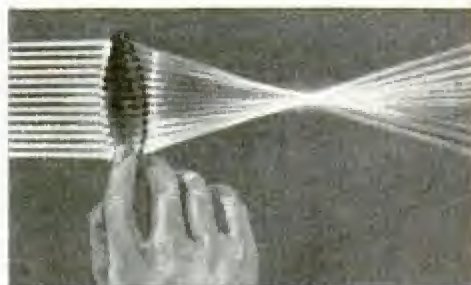
Ultra-high-speed tube is ready for a millionth-of-a-second X-ray picture of a bullet passing through wood in Westinghouse laboratory

2963



Inspecting goggle lenses used by Army and Navy air pilots

Below, lines of light are converged by double convex lens; drawings at right show how light is bent by other media



Light rays passing through a cylinder in a plane perpendicular to its axis are refracted (bent)

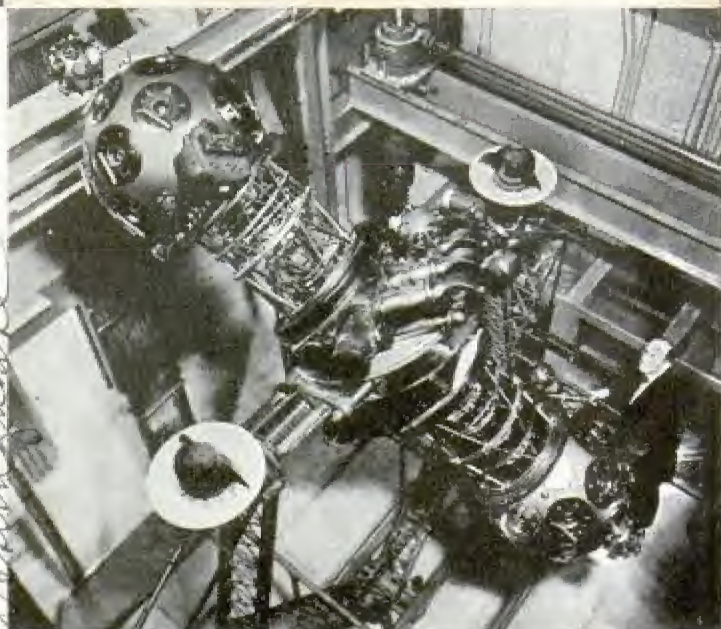
Light rays passing through a concave lens are bent apart

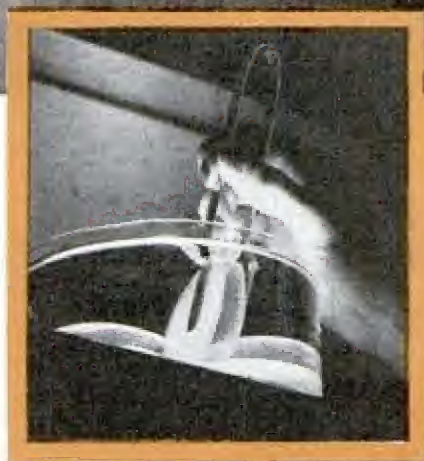
Light rays passing through a prism are bent toward the base and away from the apex of the prism

all of the performers clearly wherever they move, as the result of the discovery recently patented. Movie sets are to be divided into zones, according to distance from the camera. Each zone has an independent bank of lights. These lights flash on and off 48 times a second, so fast that to the eye they seem constantly lighted.

But the camera is faster than the eye, and in front of the machine, instead of the limited single lens, whirl a number of lenses, one for each zone. As the lights flash on in a certain zone, the lens which

Star projector in Pittsburgh's Buhl Planetarium is focused by complicated electric mechanism including a special elevator





tical Company at Rochester, N. Y., where a new lens enables a single photograph taken straight down to show accurately three times as much area as previously possible from the same altitude. This remarkable lens will take a photograph at a height of three miles in which every detail of the landscape is clear within an area of 28 square miles. Covering a field of 90 degrees, it is also possible to photograph fortifications, plants or troop concentrations without flying over them.

With aerial light bombs, and better lenses, color photographs can be taken from military planes at night with such effectiveness that they penetrate camouflage. The flashlight bombs give billions of candlepower over a wide area. By using different colored flashes and various color films, camouflage dependent on color is exposed.

(Continued to page 178)

↑ Case-hardened Bausch & Lomb goggles for industrial workers are tested by a barrage of steel balls from an air gun

← Inspecting molded and annealed lens blanks for fire cracks, striations and large bubbles at Eastman Kodak factory

U. S. Army Air Forces photo below shows aerial camera with telephoto lens



Suds Fed Into Scrub Brush Clean Carpets and Floors



Tank at right has pump to force suds through brush

Carpets, rugs and floors can be washed quickly with a scrub brush equipped to discharge soapsuds over the surface. Five or six strokes on the pump of an attached tank sends a stream of suds into a connecting tube, and pressing a lever releases the suds through the brush itself. There is so little moisture in the sudsy mixture that it is unnecessary to remove rugs or carpets, for after scrubbing is completed the suds, with the loosened dirt, can be wiped off the surface before moisture has penetrated.

Antiseptic Clothing Aids Health And Deodorizes Itself

Clothing made from specially treated fabrics which kill germs offers a new means for protecting health and avoiding body odors, declares Dr. L. H. James of the University of Maryland. The fabrics are merely self-antiseptic, keeping themselves free of germs. When such clothing is worn, infections in skin cuts are less likely to develop, people with athlete's foot are less

likely to reinfect themselves, and the chances of getting skin or scalp infection from hats, girdles and underwear that others may have tried on are reduced. Virtually all leather hat bands are now made of self-antiseptic material; some 15,000,000 mattresses are made of treated fabrics; more than 2,000,000 pairs of self-antiseptic canvas shoes were turned out in one year, and over 4,000,000,000 such pieces as sheets, pillowslips and night clothes were treated, Dr. James revealed in showing that the new treatment is more than a fad. Because body odors are due to bacterial growth and decomposition of organic matter in perspiration, the treated fabric remains free from offensive odors.

Adjustable Glass Drawing Board Is Lighted From Beneath

Preparing drawings on mimeograph stencils, making pencil or ink tracings, and similar tasks can be accomplished easily on an illuminated glass drawing board mounted on a pedestal. The board may be tilted sharply or turned completely around on a ball joint and locked at any convenient working angle. The translucent glass top is illuminated from beneath with a cool light diffused evenly over the surface. Drawings to be traced may be clamped under the drawing paper or stencil. The light shows the lines clearly. Ruling, writing, lettering or proofreading are among other jobs aided by the lighted board.



Light under glass drawing board illuminates stencil

POPULAR MECHANICS

P.B. Slick Co
720 W. Jackson / Chicago

Revik Products Co. Inc.
22nd Street
New York City

College Park
Ind.

21294.

21280

21291

Blowing Whistle Helps Adjust "Noise" Meters

It's all part of a day's work when a tester in the General Electric engineering laboratory blows a series of blasts on a brass whistle before a sound-level meter, better known as a "noise" meter. The purpose is to make preliminary calibration of the meter. Since the whistle emits a note of known loudness, it can be used while adjusting the screw that controls the sensitivity of the meter's vacuum-tube amplifier. Final calibration takes place in a soundproof room. Sound-level meters are widely used in commerce and industry where the study of noises is essential in promoting efficiency, safety or comfort.



One blows the whistle while another adjusts sensitivity of "noise" meter

Balloon Wrapped in Chains Scours Inside of Pipe Lines

Inside walls of pipe lines can be scoured clean of scale, roots and debris by an in-



This Rotary Crawler, a chain-covered inflated ball, scours pipes clean; it can be adapted to oil lines

flated rubber ball covered with chains, developed for use not only in water supply lines but in industrial, chemical and ore plants using pipe lines to carry various liquids. This Rotary Crawler is inserted in the pipe, then inflated. The pressure of the liquid flowing through the pipe forces the ball along, and it scours as it travels. It is made of a specially compounded rubber, and could be adapted to use in oil or gasoline pipe lines if synthetic rubber were used. Being flexible, it adapts itself to turns or irregularities in the pipe.

Plane Refuels Tanks by Tossing Gas in Rubber "Sausages"

"Sausages" dropped from the sky may be the means of refueling mechanized forces stranded far from supply bases. In experiments conducted by Army experts, gasoline and oil stored in sausagelike rubber bags have been tossed from planes. The containers, attached to inexpensive burlap parachutes, fell from heights of nearly 1,000 feet without bursting.



A living tree is moved to stage of the Bowl for natural scenery

vast stage is done by heavy-duty trucks with padded bumpers, winches, jacks, block and tackle. It takes but one of these trucks to shove offstage the 120-ton orchestra shell, a steel-and-wood structure rolling on steel rails set in the stage.

The Bowl is in reality "a theater on wheels." Stage directors have revolutionized backstage technique by making every unit a mobile unit. Sets are built on small rubber-tired wheels. No "flies" are used to hang the scenery, and all sets are constructed from scale models.

Real fire, smoke, and steam, of startling proportions are used in some presentations. Electrically operated flares are mounted on a sort of tri-wheel "scooter," with re-

TRUCKS MOVE LANDSCAPE in the BIG BOWL



At left, the 120-ton orchestra shell is moved offstage by truck

Stage sets are built from the ground up, as in the movie studios, from actual scale models

THOSE stage hands in the Hollywood Bowl draw assignments you'd think were business for army engineers. Moving 12 full-grown, living trees on the stage for a single act was one sample.

The Bowl itself—a "natural" theater formed by hills, with a canyon for entrance—and all its properties are on the colossal scale you'd expect in Hollywood. It has seated 26,000. Scene-shifting on its



21199



flectors behind the fire and chemical pans almost five feet in diameter. When these flares were first tried at a rehearsal, the effect was so realistic that apprehensive citizens turned in a fire alarm.

Another innovation is the traveling light-control towers, two and three-deck scaffolds on wheels, carrying up to ten large heavy-duty motion-picture studio searchlights.

Stage microphones are connected to amplifying equipment in a concrete "pill box" directly behind the conductor. The "pill box" affords a view of the entire stage for the technician at the amplifier controls and his musician assistant.

Silhouetted against the Bowl, filled to capacity, is its huge shell

Sunk in ground near stage is this control board for sound amplifiers



John Ellis, musician

Herling M. Stevens
sound technician.

21311 Conf. J. Stirling
Leitchall, dno.

Long-Term License Plates Save Steel for Defense

New Center Policy. Helms



Metal strip for 1942 covers old date on license plate

Close to 50,000 tons of steel a year, it is estimated, could be saved if all states would adopt a plan to use five-year automobile license plates. The state of California is issuing a narrow "cover strip" that extends completely across the top of the 1941 plate, as one step in that direction. The strip is painted in reverse colors to distinguish the licenses which have been renewed. In Connecticut and Delaware license plates provide a space for attachment of new "date" inserts each year.

Right Ear Doesn't Hear the Pitch Your Left Ear Hears

You may never be able to sense it, but it has been determined that your ears are a bit out of tune with each other. Tests made by Dr. S. S. Stevens and J. P. Egan of Harvard University show that persons with "normal" hearing perceive the pitch of the same tone as higher in one ear than in the other, while in defective ears this "double hearing" sometimes exists to a striking degree. The apparatus used in the

Science Service
Sept. 12

experiments delivered a separate tone to each ear. Individuals listened first with one ear and then with the other, adjusting the pitch of one tone until the two matched. Sometimes one tone had to be altered in pitch as much as two and one-half percent to make it sound the same as the tone heard by the other ear. This difference in perception between the two ears was found to be greater with faint sounds than loud ones.

21285

Hydraulic Tube Sucks Up Gold From Bottom of River

Gold-bearing sands may be worked by one man using a hydraulic dredge which allows the operator to gather material from beneath large boulders, to mine river bottoms and to draw material from 30-foot depths when extensions are used. The dredging outfit consists of a hollow tube, a moving endless chain to help material rise in the tube, a hose at the upper end leading to a suction pump, and a small gasoline engine requiring a gallon or two of fuel per day. Along with sand and other material, the dredge picks up the right quantity of water for efficient operation, and discharges the aggregate into a sluice box.



Hollow tube dredge lifts sand and gravel from river

POPULAR MECHANICS

Bernhard Bros
Machine Shop

Cambridge
Mass
76
1067

1941 & Colorado St. Pasadena Calif

21279

Lights Help Simplify Music Chart for Children

Children in an English school are learning to sing by a simplified method devised by William Willmott. With the aid of flashing lights upon a chart, it becomes easy for beginners to correlate the tone with the key on the piano and its place in the staff. The chart includes a reproduction of the piano keyboard as well as the staff, and a series of electric lights which are connected with the keyboard of a miniature piano. Striking a note on the piano turns on corresponding lights in the chart.

Watching chart, children can gain clear perception of relationship between tone, keyboard and staff when note is struck



L.E. School

English Combine Photos

Black Light Guides Army Trucks Under Cover of Night

With a new adaptation of black-light rays, United States Army trucks can be convoyed rapidly at night without the use of lights that might betray their presence to enemy planes overhead. Each truck has mounted at the back a greenish disk, barely

noticeable, which glimmers in eerie fluorescence. Only the driver of the truck following can see the "invisible" disk, which glows vividly before his eyes as he sights it along a black-light beam emanating from a point near the windshield of his own truck. The leader of the procession finds his way with the aid of disks of a similar type, mounted on stakes, which are stuck into the ground along the route.



Driver sights disk in black-light beam from his truck

Steel in Discarded Razor Blades Could Build Many Tanks

Each year American men toss away 3,000 tons of high-grade steel in used razor blades which would be suitable for armament, says American Iron and Steel Institute. One company alone requires 50 tons of steel a year to make tiny staples like those at the base of match books. Paper clips account for an additional 1,200 tons of steel annually. Steel parts in men's suspenders would provide enough steel to turn out ten 25-ton tanks, and metal in women's corsets would equal 25 destroyers a year based on 1,000 tons of steel per destroyer.

MARCH, 1942

Reese Engineering Co 350 - 5th Ave New York City

7200 Black Santa Monica Blvd

350 - 5th Ave New York City

2850. Leggett

The TRUTH about LIGHTNING

American Museum
of Natural History

Dr. Frederick H. Porcup. Acting
Curator of Mineral and Fossil



When lightning hits sand, a piece of silica glass like this is sometimes formed

Fulgurite

Big surge generator undergoing final checkup before producing a 3,000,000-volt stroke of lightning in laboratory



Three million volts of man-made lightning hits car while author sits at wheel

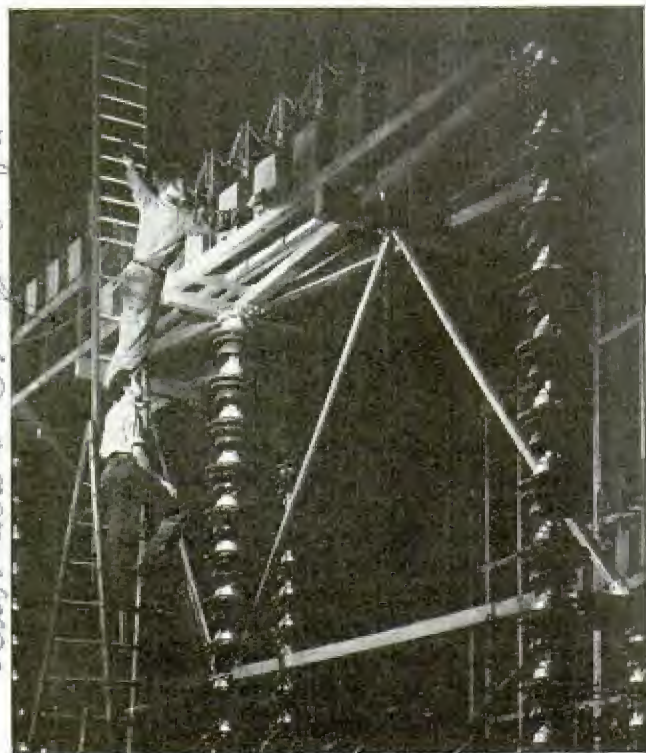
By Dr. Gilbert D. McCann

Westinghouse Electric & Mfg. Co.

E. Pittsburgh, Pa.

CHANCES of your being injured or killed by lightning are so slight that it's a waste of time to heed most of the popular beliefs regarding what you should and shouldn't do during a storm.

Our engineers, studying Nature's mightiest and most feared force, have found these beliefs based largely upon freakish occurrences or upon pure superstition. You undoubtedly have been warned against using the telephone during a thunderstorm. Because the Bell System employs protective devices and methods, there is very little, if any, element of danger from shock. As proof of this, many millions of calls are made each year by subscribers during storms and injuries under these circumstances are extremely rare.



Westinghouse high voltage
Laboratory, Trafford, Pa.

2858

Westinghouse high voltage laboratory, Pa

Shirt after being ripped by blast of "cold lightning," which does not last long enough to burn

Then you are told to turn off the radio when lightning begins to flash. We have found it entirely untrue that the antenna is more likely to be struck by lightning when the radio set is turned on. Of course, the antenna, if mounted very high above the ground, might be a good target for a lightning stroke, but if it is properly grounded little danger will result from its being struck. The radio set, too, will not be damaged if protected by recommended devices.

"Don't sit near an open window; close all windows and doors," someone else advises. Our studies show that there is hardly any more chance of lightning coming into a house with the windows and doors open than with them closed. We have determined that it probably is safer to be in the center of a room and safer to be on the lower floor. That's because a bolt striking the house probably will pass through the walls.

Many a mother has stern-



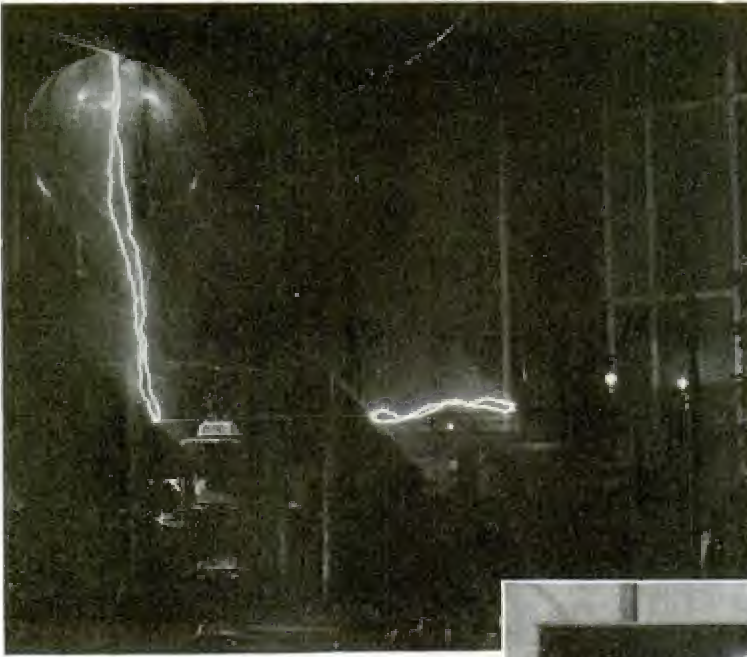
Model house protected by miniature lightning rod → withstands bolt of man-made lightning

One of the first photographic records made of direct stroke on a transmission line ↓



MARCH, 1942 made with klydonograph developed by Westinghouse

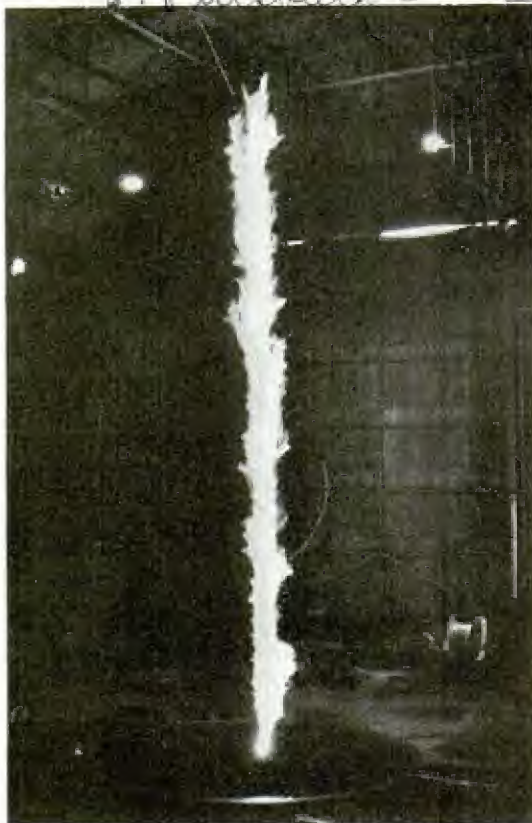
Westinghouse Laboratory, Trafford, Pa.



↑ *Shafford*
High voltage electricity jumps 15 feet across
spark gap in laboratory test

Result obtained by controlling 3,000,000 volts →
of electricity to form pattern

Shafford
Million volt arc leaping 90 feet from insula-
tor to ground in Westinghouse test



ly warned her son, "Don't go swimming during a lightning storm." As far as the risk of being struck by lightning is concerned, it probably is no greater in the water than out of it. Indeed the odds favor the water. However, if the resistivity of the water is high, a stroke to the water near a person may cause enough current to pass through the body to produce discomfort and possibly cause death through drowning — and fright probably might be given

a large share of the blame in such cases.

Farmers long have passed this one down from father to son: "Keep cattle out of barns because their warm bodies attract lightning." This is purely superstition. Warm bodies have no greater attraction for lightning than cold ones and the hot air rising from the barn is no better conductor than the hot air rising from an office building. Another bit of advice also sprung from superstition is: "Don't milk cows during a storm because it will turn the milk sour." The souring of the milk is due to specific bacillus fostered by warmth. If strict cleanliness is adhered to and the milk is chilled to the proper temperature, it will make no difference whether the milking is done during a thunderstorm or in fair weather.

2850

Many housewives wouldn't dream of using electrical appliances, such as fans and irons, during a storm because they have been warned it is dangerous. In large communities the transformer supplying each house is thoroughly grounded and the likelihood of being shocked is slight because the lightning current will be diverted to the ground. Nevertheless, if you are inclined to be nervous during a storm, it certainly is a harmless precaution to delay using the electric iron because in all probability the nervous tension is more dangerous to your health than the lightning.

Many people believe that you should avoid all metallic objects when lightning is near. Generally, that is true, but there are cases in which the presence of metal saved a life. For instance a man sleeping in an iron bed was not hurt when lightning passed through the bed. Being a good conductor, the bed was at practically the same voltage over its entire surface and the man in it had no voltage produced across his body. So it is relatively safe to be near any metallic object that is well grounded and unsafe to be near ungrounded objects.

If you get caught in the open, don't get under a tree. Engineers find that trees will attract the lightning, thus protecting the person standing under them, but that they are not good conductors of the enormous currents in lightning strokes—sometimes hundreds of thousands of amperes—and if the person is close enough to a tree trunk, sufficient voltage may be produced across it to flash over the human body and into the ground, bringing injury or death.

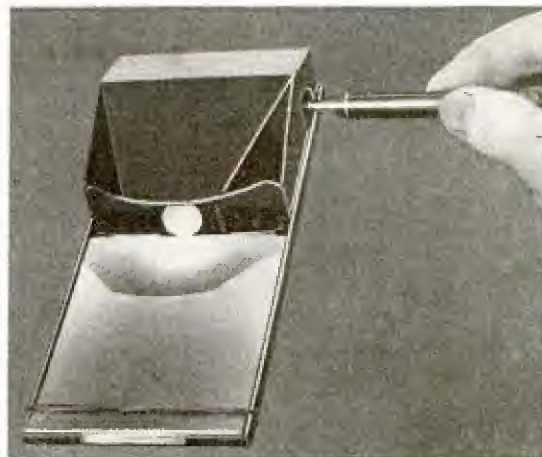
Almost everyone knows by this time that lightning does strike more than once in the same spot. For instance, the 40-story Cathedral of Learning at the University of Pittsburgh is struck about three times a year. On top of the 530-foot building, a 50-foot insulated mast has been placed and Westinghouse engineers studying lightning have connected to the mast special recording equipment. Lightning strokes to the mast pass through this recorder to the building grounding system. The 1,250-foot Empire State Building in New York City is struck about 20 times a year.

Steel frame buildings are doubly safe because not only do they provide a good target and conducting path for lightning strokes to ground, but their steel framework forms a Faraday cage. It was Michael

(Continued to page 176)

MARCH, 1942

Writing Pad Turns on Light When Pencil Is Removed

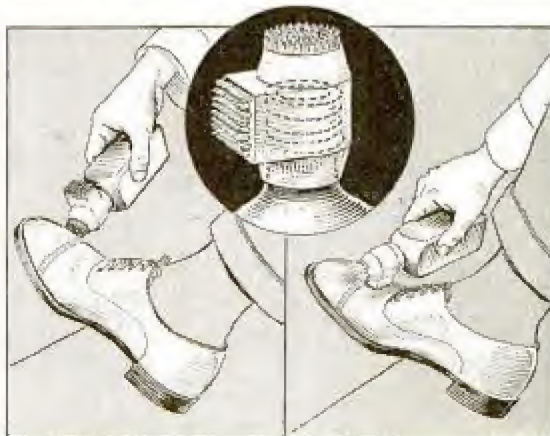


Memo pad light is turned on by removing the pencil

For convenience in making notations in the dark, a memorandum pad equipped with an electric bulb lights up as soon as the pencil is removed. Replacing the pencil turns off the light. Regular flashlight batteries, obtainable in dime stores, are used. The pad is handy in automobiles, at the telephone stand or on a night table.

Dauber Cap for Shoe-Shine Bottle Dispenses Liquid Through Top

Made of rubber, a shoe-shine dauber that fits over the bottle like a cap applies liquid through a slit at the top when pressed



Left, applying liquid; right, rubbing it into shoe

against the shoe. Both the top and one side of the dauber have bristlelike projections of rubber, the side section being used when enough liquid has been spread over the surface of the shoe.

Pittsburgh
Pa.
85
Pittsburgh applicator
Co. Box 7341 Oakland
Station

*L 1230 Com. L. H. Houch Tampa
5911 Gustave Florida
Aqua Bike*

Foot-Powered Water Bike Floats on Oil Drums



Treadles turn paddle-drum to propel odd fishing craft

By assembling three oil drums and some bicycle chain and sprockets, Tom Sydnor of Richmond, Va., constructed a pedal-driven water craft. Four paddles on the front drum, which is turned by the pedals, propel the aqua-bike. On land the paddles do not touch the ground, making it easy to move the unit about on the other two rollers. The craft is four and one-half feet wide, nine and one-half feet long and weighs 350 pounds. It carries two men and is especially suitable for fishing since it does not stir up water and makes no noise.

L 1281

Simple Gauge for Furnace Draft Checks Flue and Chamber

Handy for installing, servicing or inspecting furnaces, a draft gauge small enough to fit the vest-pocket is easy to read



Gauge checking amount of draft in furnace elbow

and requires only a few seconds to operate. To take a reading it is only necessary to insert the instrument into a $\frac{3}{16}$ -inch test hole in the flue pipe, furnace door or chimney. The volume of draft in each instance is shown on a dial. Useful on coal, gas and oil-fired furnaces, the gauge is of the "dry" type, insuring long life since it lacks intricate mechanism that may get out of order. The information it gives is often indispensable for setting the draft regulator, locating basement odors caused by a faulty furnace, checking up on air leaks in the chimney, and as an aid in obtaining the best possible combustion.

L 1185

Tachometer "Feels" Motor Speed By Contact With Housing

Held against the housing of an enclosed motor, a vibrating-reed tachometer indicates the speed at which the motor is running. It needs no contact with the rotating element. Steel reeds within the instrument,



Speed of vacuum-cleaner motor found from outside

Is over
working on a principle as simple as that of the tuning fork, become energized by the vibration of the machine, which is related to its speed, and in turn there is shown on the face of the tachometer the revolutions per minute or the rate of the machine's vibrations, as the case may be. It may be applied to large machines such as turbines, generators and airplanes, as well as to electric shavers, portable electric tools, oil burners, electric refrigerators, centrifugal pumps and pneumatic drills and hammers.

*no serial address needed
Bacharach Industrial Instrument Co., 7000 Bennett St.*

21292. Capt. Paul Lersey 4484
 Beverly Blvd. Los Angeles

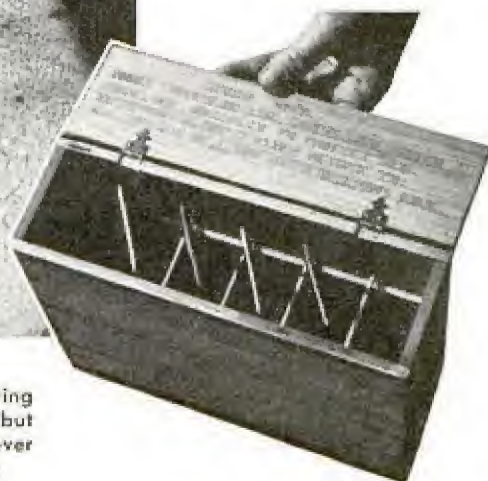
Putting Spiders to Work for National Defense



The living room of Mrs. Nan Sanger's home in Yucaipa, Calif., is a spider farm. Harvesting spider silk is her business, an essential one for national defense as the silk is used for cross hairs in aiming devices of bomb sights and telescopic rifle sights. Above, she reels silk from a spider "anchored" to a section of yucca plant by a hair-pin. Twelve frames hold 100 feet of silk

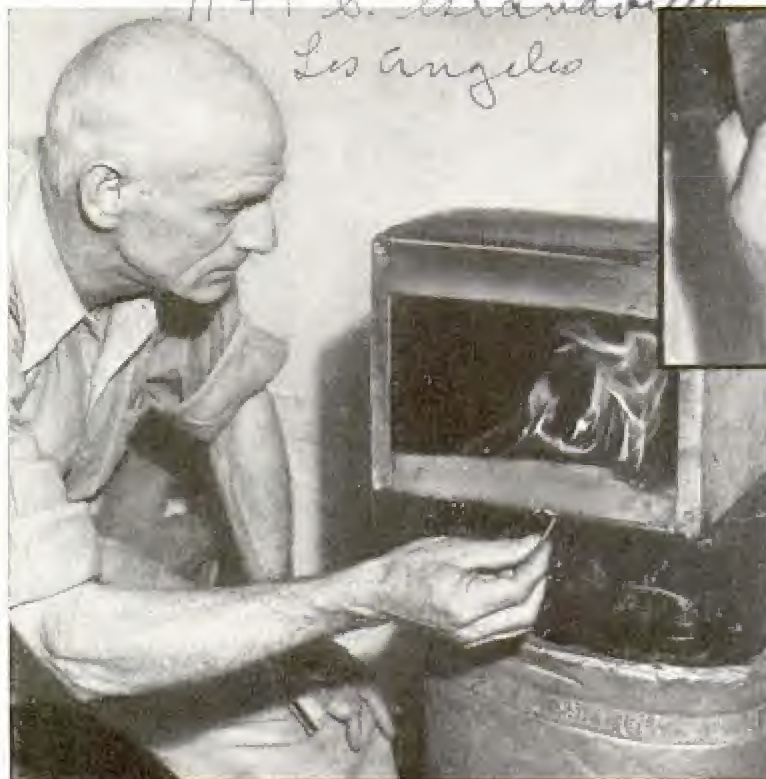


Spiders are kept in glass jars (above), fed live or freshly killed flies, gnats, etc.; fast two days before being silked. Yielding 100 feet in an hour, which brings \$10, the spider is then rested two days, released after 5 "silks." Silk-wound steel frames are shipped to manufacturers in boxes (below)



Black Widow spiders produce stronger silk used in surveying sights. Above, Mrs. Sanger grips Black Widow's leg lightly but firmly with tweezers, prepares to reel out silk. She has never been bitten. The "work table" is pithy section of yucca

21279. *Emil Mel Wharton*
 1144 *S. Brandover*
Los Angeles



Three kinds of rubber made from milkweed are used in three layers of self-sealing aircraft fuel tank

This rubber tank, left, is still resilient after 500 fires inside it

Below, 18-pound milkweed; plants average five pounds each and produce 18 to 28 tons per acre

RUBBER *from* MILKWEED

AFTER five years of tests, an American scientist has developed from common milkweed a high-protein rubber which will not burn or melt, nor decompose in gasoline, yet will vulcanize on contact with gasoline or alcohol.

Milkweed can be harvested nine months after planting. This is in contrast with the average 15-year wait for trees to mature, as with para rubber, the only other important source of natural rubber. It is claimed that extensive planting could make the United States independent of foreign sources in two years!

The inventor is William A. Sharpe, chemist and mining engineer of Alhambra, Calif., with more than 400 inventions to his credit, including a radial gasoline engine, a submarine detector, and numerous airplane designs and accessories.

The milkweed rubber has undergone tests recently at the Douglas Aircraft plant. The rubber is jet black, odorless and tough as shoe leather. In a small section resembling an airplane's fuel tank, the inventor has built more than 500 gasoline fires, and the rubber is said to be as pliable today as before the flame tests. Countless bullets were fired through 3-layer tanks filled with gasoline, yet not a drop of gas was spilled. Only the framework of the new tanks is metal. The



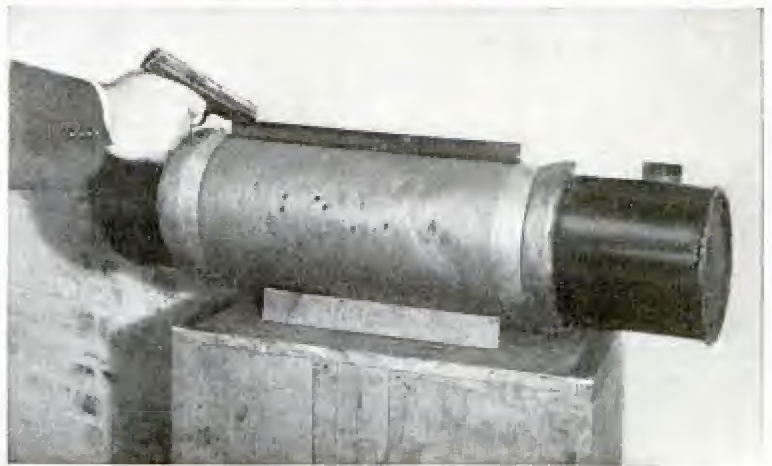
covering is entirely rubber, saving nearly a pound for each square foot of surface. The inner layer of tank rubber is gasoline-resistant. The center core is soft rubber which vulcanizes the instant fuel touches it, while the outer layer resembles an automobile inner tube and is reinforced by nickel alloy wire mesh.

To prevent explosions from static electricity the small amount of metal in the tanks is grounded to metal in the plane's structure. The electricity is fed back into the atmosphere by wires trailing from the wings.

Burlap sprayed with one form of the new rubber will not burn. Several chunks, immersed for a full year in gasoline, retain their elasticity and perform almost like newly rolled strips.

Milkweed grows rank and naturally throughout much of the nation. Cultivation would, it is believed, produce enough rubber in two years to furnish all domestic

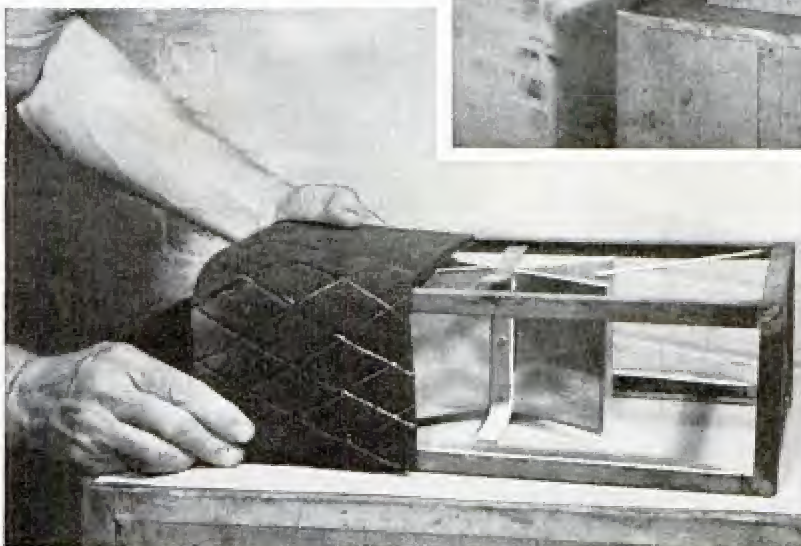
(Continued to page 163)



At top, a 7-foot strip of pure milkweed rubber, which was rolled into shape like ordinary para rubber. William A. Sharpe, inventor, at right

Half a dozen holes were blown through the rubber-coated gasoline tank above, yet not a drop escaped. The six bullet holes in rubber wall are plainly seen

Left, model of an airplane fuel tank showing how milkweed rubber is used in place of the usual metal sides. Using only a metal frame saves weight



21229

Mirror in Hood of Carriage Keeps Baby Amused



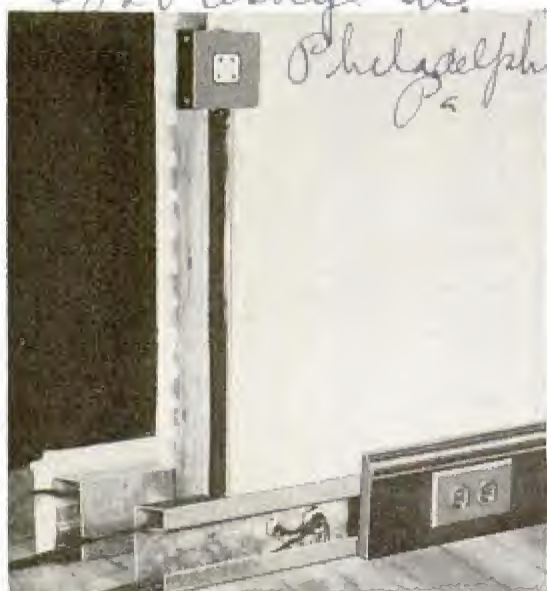
Baby enjoys own reflection while mother is absent

To keep the baby from crying when mother must leave him alone, a mirror attachment for the carriage provides amusement by letting the baby watch his own reflection. The mirror is built into the hood and swings down in front of the infant.

2968

Electric Outlets Easily Added With Baseboard Conduit

Electrical outlets and telephone connections in the walls may be added easily anywhere in a house furnished with a wire-



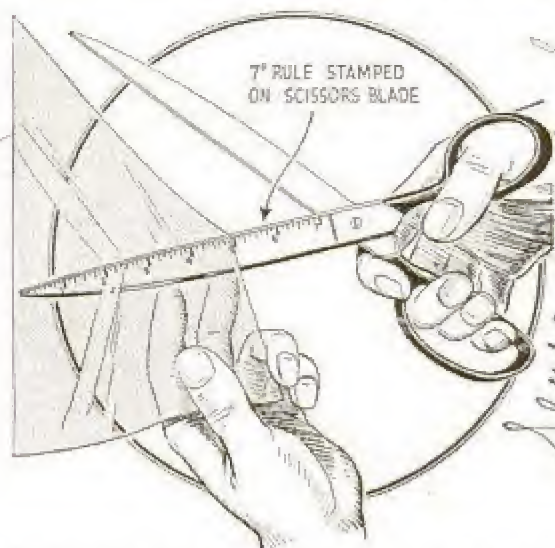
Baseboard slides off and on wire conduit set in wall

carrying conduit base now available. All the wiring is concealed by the baseboard which slips off quickly whenever you want to get at the wires. It offers an additional convenience when refinishing or repainting the walls, floor or baseboard, as the board may be removed to avoid smearing paint where it is not wanted.

21152

Scissors Blade Ruled in Inches Aids Precision Cutting

Cutting to exact measure is simplified with scissors marked with a seven-inch rule on one blade. Dressmakers, tailors,



Scissors marked with 7-inch rule save time and work

artists, photographers and paperhangers may use these ruled scissors for quick precision cutting without the preliminary measuring with tape or ruler.

21275

Twin Windshield for Air Liner Eliminates Window Icing

After testing windshield wipers, fluids and application of heat to the inside surface, United Air Lines have adopted a double windshield for use on their Mainliners to prevent ice from forming and blocking forward vision. There are two panes, the front one being of quarter-inch safety plate glass and the rear of eighth-inch transparent plastic. These are mounted with a quarter-inch air space between them. Air heated to 175 degrees is passed through the air space. The air, moving at the rate of 60 cubic feet per minute, can be controlled through a valve at the captain's elbow.

Charles E. Barnes & Son.

Chicago

Sears, Roebuck & Co. State Street

Philadelphia

4320 Orange Ave.

21218

Versatile Thresher Promotes Seed Growing

Soil conservation by owners of small farms is encouraged by a small, low-cost, portable threshing machine that makes it possible to produce economically home-grown legume seeds and small grains to meet the increasing need for livestock feed. The machine was developed by the Tennessee Valley Authority in cooperation with state agricultural agencies in the south. Having about half the capacity of large machines in common use, the thresher may be used on crops from small acreages and is adjustable for hilly and rough ground. In one hour it will thresh 50 to 90 bushels of oats, 25 to 50 bushels of wheat, 10 to 20 bushels of lespedeza, or one-half to two bushels of other cloverseed. Flax and buckwheat also have been threshed satisfactorily. Roots and rocks will not injure the mechanism. The cylinder is of hammer-mill type construction, containing 243 swing bars spaced close enough to do effective threshing. For small grains, clovers and grasses the cylinder

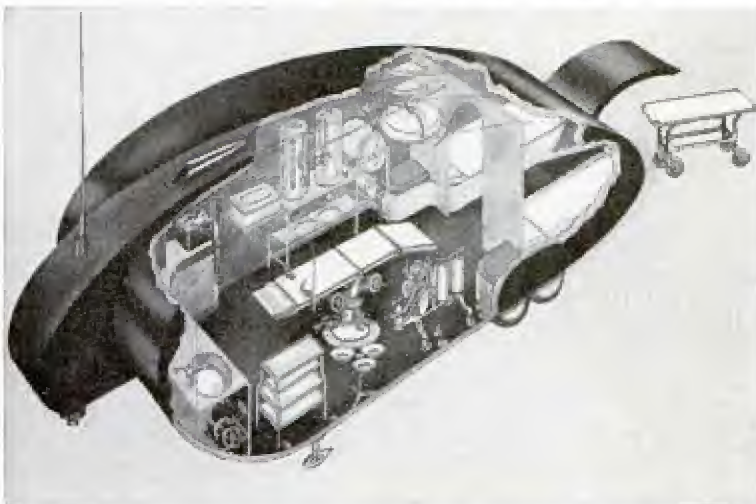


Low-cost thresher being operated in hilly country for which it was designed. After grain has been brought in, three men can do all the work

speed is about 1,200 revolutions per minute. Either a seven-horsepower gasoline engine or a five-horsepower electric motor will run it. The thresher consumes about five gallons of fuel in a ten-hour day, and requires only three men for its operation after the grain or hay has been cut and brought in. This means that a single family or a few men from adjoining farms can handle the thresher, as against a crew of eight to 20 needed for larger machines.

*The larger motor Co. of
Tennessee*

Hospital for Modern Warfare Designed to Follow Army



Artist's sketch of proposed mobile hospital unit shows spacious interior wherein could be carried equipment necessary to perform major operations

To provide hospitalization facilities for casualties among advance troops, a complete hospital unit within a trailer has been proposed which can be towed easily behind a truck or armored car. The trailer would be air conditioned and gas-proof, having its own two-way radio, water supply, and a gasoline-driven motor generator to operate lights and provide heat for the sterilizer. The unit would permit making major operations in the field.

Los Angeles, Calif.

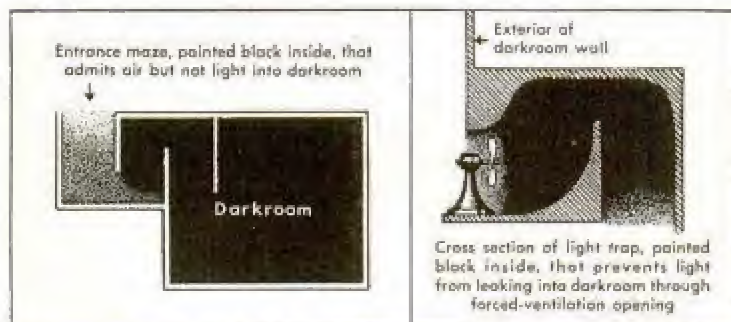
MARCH, 1942

*Byrtcher Corp 5087
Huntington, Ark.*

THROWING LIGHT on the



Negatives held by clips are dried by the heat of an infrared lamp in this cabinet drier; notice the tiny fan



YOU will enjoy photography more when you do your own developing, printing, and enlarging, for which you should have a permanent darkroom. A six-by-six closet, or space in the garage or basement is satisfactory if you can make it light-tight and connect running water to it.

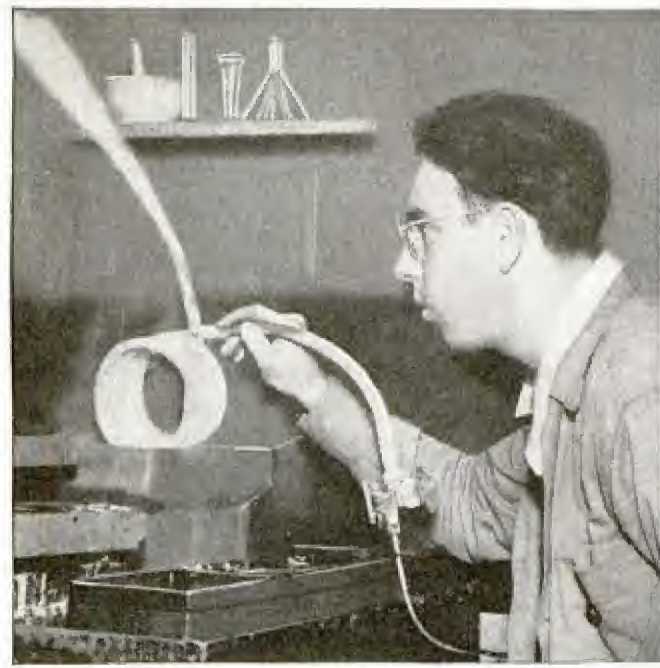
You should exclude all light, and you need ventilation for comfort. Some photographers use an open entrance maze instead of a door, to stop light yet permit air to circulate. This entry is a passage that has two 180-degree turns. Paint the walls, floor, and ceiling of the maze with flat non-reflecting black paint.

In hot weather you may need forced ventilation, with a hole in the wall or ceiling

Timer operated by vacuum tube turns enlarger lamp off at correct time for making duplicate prints

POPULAR MECHANICS

DARKROOM



↑
Carbon-dioxide gas exhausting through coil speedily cools photo solution to right temperature



Homemade spotlight has a built-in fan to keep the powerful bulb cool and thus prolong its life
↓

↑
Enlarger is mounted handily on stand, with plenty of room for photographer to walk around

large enough to take an electric fan at least 10 inches in diameter. The fan opening, of course, should be protected by a light trap maze that has two 180-degree turns, with all interior surfaces painted black.

Photographers once painted the interiors of darkrooms black but modern practice is to make the walls and ceilings light. Such reflecting surfaces give better visibility under safelights and since no light is stronger than its source there is no danger that the reflected light will be harmful. Use a light tint such as seafoam green and finish with a glossy coat that is easy to clean.

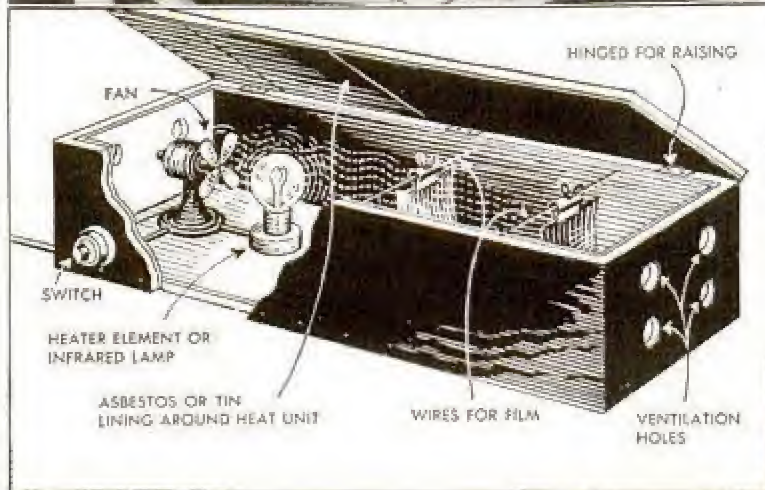
Arrange your shelves and working spaces according to the space available and the equipment you are going to use. It usually works out best to place a large sink, that you may get second hand, in the center of a working table that



2770



Four 100-watt bulbs inside this homemade print drier provide heat; canvas holds drying tin in place against curved metal top. Below, a film drier is sketched



and fixing trays one above the other in a rack, each tray staggered five inches forward of the one above.

Plan your electric wiring in advance, with a safelight reflecting against the ceiling for general illumination except when developing negatives, a white light that you can switch on and off by pulling a cord stretched overhead across the room, and a photographic safelight illuminating the area at which you will develop prints. If you use one of the new plastic safelights, shield it with cardboard to keep the light out of your eyes. A shielded 7½-watt bulb in a night-light base

Metal fingers keep paper holder in position on easel board used with horizontal enlarger



should be at least two feet wide and drain toward the sink from each end. Cover the table top with several coats of black acid- and water-resisting preservative paint. A good grade of linoleum thoroughly rubbed with wax also makes a good surface. If other plumbing facilities aren't available you may run a ¾-in. copper-tube pipe from the nearest water outlet to an ordinary faucet over your sink. A satisfactory drain from the sink consists of a length of garden hose, led outside the house, to a cesspool made by digging a six-foot hole and filling it with rocks and boulders.

You need plenty of shelf space. The shelves should be reserved for papers, dry chemicals and supplies, with storage space on the floor or under the sink for bottles of solutions. If you need to save space you may mount your developing, short stop,



2770

makes good indirect illumination for the photo timer, which may consist of an old alarm clock.

Many pieces of needed darkroom equipment seem expensive and you can save money by buying tongs, trays, camel-hair brushes, and so forth at the five and ten cent store. Use an inexpensive window squeegee instead of a rubber roller for removing excess water from tinned prints.

Most amateur enlarging machines are mounted vertically. If you have space and if your machine can be turned on its side you may wish to mount it horizontally. The advantage is that you won't have to stoop for focusing. For horizontal projection it is best to mount the easel board on an overhead track so that it can be pushed as far away from the enlarger as desired. To avoid using one of the bulky lamp houses you may attach one of the new flat lightweight mercury argon light packs to the enlarger.

If the focal length of your enlarging lens is too long to "blow up" negatives to the size you desire, place one of the new portrait lens attachments over it. These inexpensive auxiliary lenses are made for taking close-ups with ordinary cameras, but they serve as well for enlarging.

Instead of the usual easel for holding paper flat while enlarging, try a new type that has a tacky surface to which the paper adheres. This paper holder consists of an open box slightly larger than the paper size you use. The bottom should be of plywood, with a quarter-inch-high rim around it. Slowly pour into the box enough heated hectograph compound to fill it. This is a sort of gelatin, obtainable at stationery stores. The compound when dry has a pliable and slightly sticky surface. It holds the paper flat and the paper peels off easily. Make sure the box is level, when pouring the compound, to obtain a level surface. The material may be dug out of the box, re-heated, and poured back again to renew its tacky surface after much use.

You can build your own enlarger, negative viewer, and other equipment. You should have a negative drier and a print drier. An infrared lamp mounted in front of a fan, in a box eight by eight inches in cross section and four or five feet long, makes a good negative drying outfit. Provide large ventilation holes in each end and protect the wood near the lamp with tin or

(Continued to page 162)

MARCH, 1942

21159

Extension for Coal Heater Changes It to Oil Burner



Extension unit converts coal heater into oil burner

Shortage of oil or higher prices will not worry owners of a home heating combination that can be converted readily for burning either coal or oil. Designed primarily to burn coal, the unit is provided with the usual jacket. The oil burner is purchased separately at nominal cost, and operates as an extension to the coal unit. The extension is easy to move and makes the oil burner accessible for servicing.

21263

Miniature Jungle in Large Bottle Consists of Growing Plants

Tiny plants which give the appearance of a dense, though miniature, forest are grown in a large bottle, now on the market. Included in the bottled forest are simulated logs, a wood nymph and creeping Ficus Repens. Chinese evergreen and



partridge berries also grow in the miniature jungle, which needs little care other than occasional watering. The special spun-glass bottle, capped with a cork that fits over the mouth, prevents injury to the plants from excessive light.

Stanley Harrison
1602 South East
Chandler, Arizona

21259

Coat Steamed and Reshaped By Pressing Form



Fin-type heater dries coat after it is pressed

Without the use of an iron, a metal bust frame, adjustable to fit all sizes of coats, may be used for pressing and reshaping a coat in one operation. The coat is slipped on the form and fastened by means of a clamp. Then pressure on a pedal releases steam from within, restoring the garment's shape and taking out all wrinkles. Warm air from a built-in fin-type heater quickly dries the coat after pressing has been completed. The manufacturer says the presser does not produce a shine on fabrics such as serge and gabardine.

21090

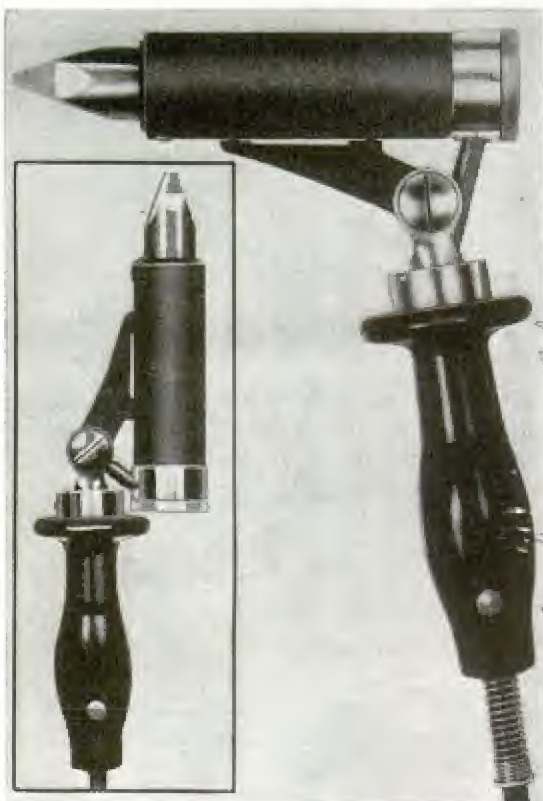
Changes in Our Living Foreseen As Result of Advances

Influenced by many industrial and scientific developments already in progress, human living as we know it can hardly escape radical changes during the next few decades, in the view of Dr. Robert A. Millikan, eminent physicist at California Institute of Technology. For instance, the advance of aeronautics for war purposes will react tremendously on transportation in years succeeding the war. Industry will be modified by new metallic alloys that combine the maximum of lightness and strength. Plastics with nonscratchable surfaces will reach directly into our do-

mestic life. Advances being made in short wave radio and in travel of radio waves through cylindrical conductors will expand communications in new directions. Health and physical well being will benefit from improved means of sterilization of drinking water, new knowledge of vitamins and their use in the fortification of foods, increased knowledge of drugs and so-called natural products gained through micro-organic biochemistry, and results of studies in immunology. Agriculture already is being revolutionized by better understanding of the mechanics of soil erosion and transport of sediments through dams. Long-range weather forecasting is having great effects on the handling of power stations, agriculture and military operations, although the science of meteorology is still in its infancy.

Soldering Iron With Pivot Head Works in Any Position

Its head pivoting so it can be adjusted to operate at any position through a 90-degree arc, a handy soldering tool is equipped with a handle comfortable to hold at all working angles. A button on the handle controls the iron for fast or slow heating.



Here are two possible settings of soldering iron

The Kintley, Moberg Co.
hampden, Mass.

U. S. Hoffman Machinery Corp.
105 North Ave.
New York

Charmion Carroll
(Executive Council)

Christian Science
monit. Sept. 27

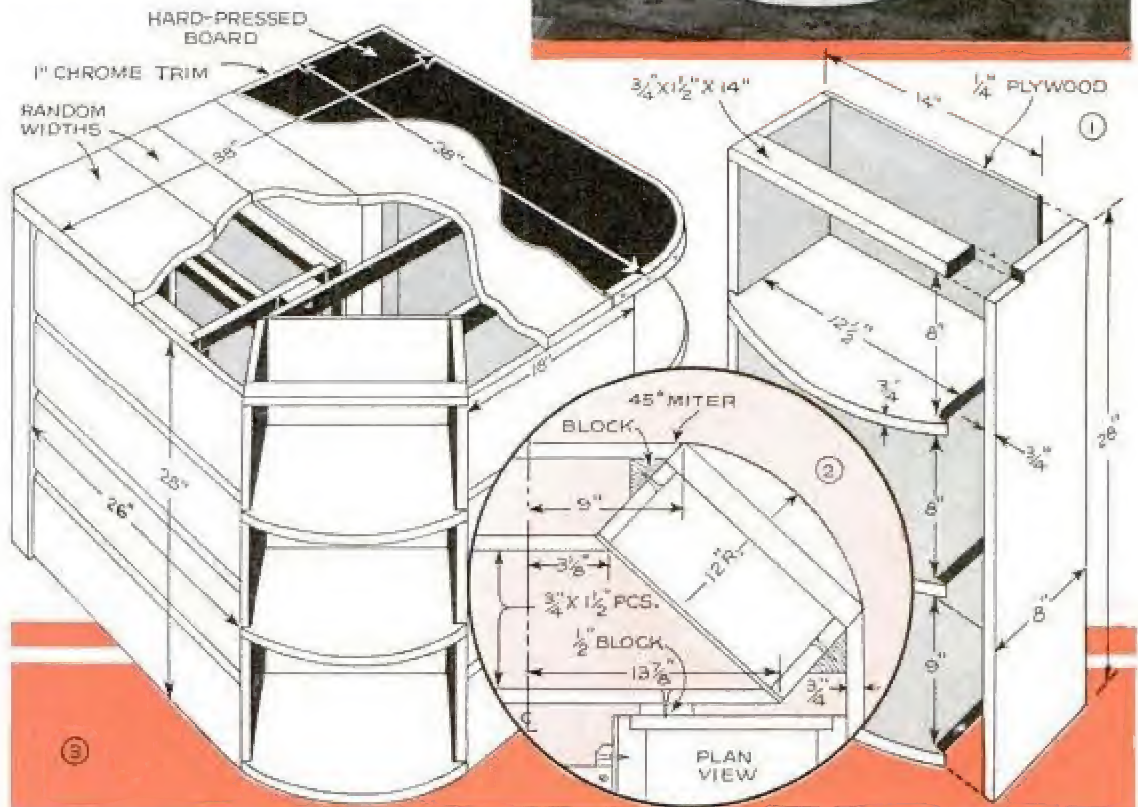
626 W. Jackson, Chicago

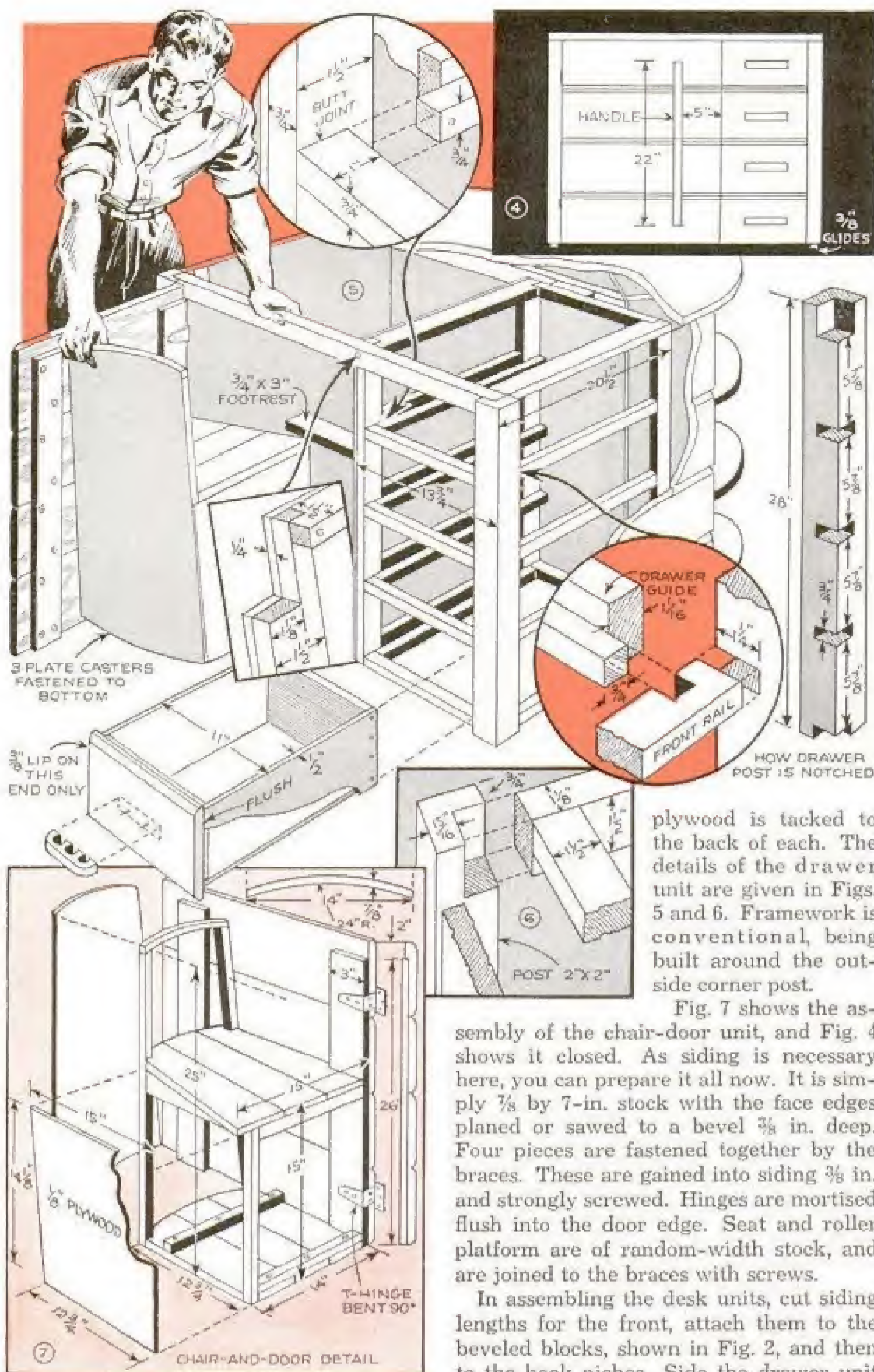


THE CRAFTSMAN

"Baby-Grand" KNEEHOLE DESK has built-in chair

NO LONGER will you have to seek your pet chair when working at a desk if you build this streamlined one, which not only contains a chair, but six book niches, and four generous drawers as well. Constructed in units, then sided and topped in prefabricated fashion, it is quite simple to build. Figs. 1 and 3 show the construction of the book-niche units while Fig. 2 shows how they fit into the desk. The three shelves, top brace and sides are first nailed together after which the $\frac{1}{4}$ -in.





plywood is tacked to the back of each. The details of the drawer unit are given in Figs. 5 and 6. Framework is conventional, being built around the outside corner post.

Fig. 7 shows the assembly of the chair-door unit, and Fig. 4 shows it closed. As siding is necessary here, you can prepare it all now. It is simply $\frac{7}{8}$ by 7-in. stock with the face edges planed or sawed to a bevel $\frac{3}{8}$ in. deep. Four pieces are fastened together by the braces. These are gained into siding $\frac{3}{8}$ in. and strongly screwed. Hinges are mortised flush into the door edge. Seat and roller platform are of random-width stock, and are joined to the braces with screws.

In assembling the desk units, cut siding lengths for the front, attach them to the beveled blocks, shown in Fig. 2, and then to the book niches. Side the drawer unit

next. Then place the back brace in the post mortises, screw a cleat to the door post and place the other siding. Next attach the chair casters and, placing the chair door in its open position, mark intersection of hinges on the door post. Now start at one side of the top and lay $\frac{7}{8}$ -in. sheathing on it, screwing the sheathing to all braces and posts. Hard-pressed board is laid into mastic, and then the chromium trim is applied.

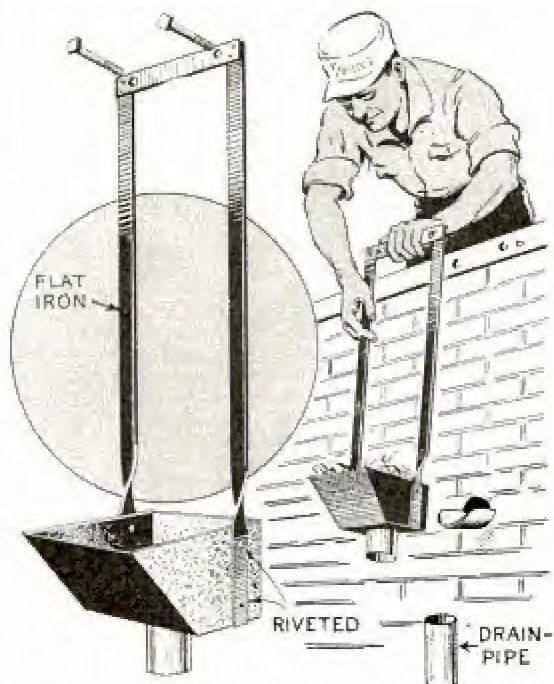
A slightly contrasting color in the V bevels, book niches, seat compartment, and drawers add a lot to the sleek streamlined appearance of this project. A natural wood top could be used if preferred, and by increasing the thicknesses of the fastening battens, the new hardwood veneer in panels could be placed on the sides.

Easy Way to Hold Waste Material When Cutting Floor Opening

Difficulty of preventing waste material from dropping down a wall or between floors when cutting openings in them, can be avoided by using an auger or doorstop of the types shown. Screwed into the waste material after the opening has been cut out partially, the auger or doorstop serves as a handle. Also, such a handle enables the workman to keep the material from binding the saw.



Handle on Downspout Funnel Permits Removal for Cleaning

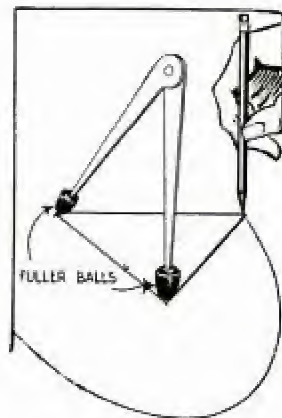


On buildings that have walls extending above the roofs, cleaning of the trash screens above the downspouts can be simplified if handles are provided for the metal funnels or receptacles at the upper ends of the spouts. Handles can be shaped from flat iron, and they can be bolted to the wall to hold the funnels in place and prevent their dislodgement by high winds.

—Andrew Vena, New York.

Ellipse Made Easily With Dividers And a Length of String

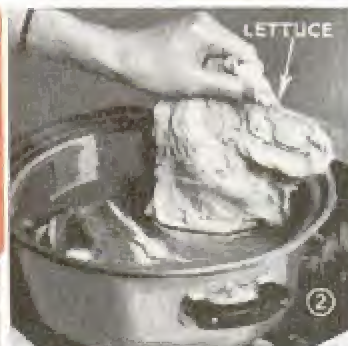
Instead of using a couple of pins and a string in drawing an ellipse, try your dividers. They are much easier than trying to push pins into a board or table top under the paper. Slip a couple of fuller balls over the legs of the dividers so that the points project slightly. The fuller balls will keep the string from slipping up too high on the legs as the pencil is moved.



Solving HOME



1—Wagon-wheel rims provide good frames to weave round rag rugs. Two sets of crossing strips are tied to the rim. After weaving center, space strips on rim and insert extra ones as needed while weaving



2—With a lettuce leaf, you can remove those last elusive drops of fat from a kettle of vegetable soup in a jiffy. Just hold the leaf as shown and the fat will stick to it. 3—Rust marks on sink drainboards caused by a scouring-powder can, may be prevented by dipping the bottom of the can in hot paraffin. One coat usually will protect the bottom from moisture until the can is empty



4—Liquid wax can be spread quickly over a floor by using an ordinary clothes sprinkler of the type shown, which may be purchased in most 10c stores. 5—Fastened to a piece of plywood, a cloth shoe holder is removed easily from a dark closet or wall, and as the entire edge is tacked, it will keep its shape even when completely filled. A rope handle fitted on the upper edge of the plywood panel will be found handy where considerable moving is done. 6—Chewing gum usually can be removed from cloth garments by rubbing the gum with a piece of ice. Often this method is superior to strong cleaning solutions as it does not leave spots on the material

PROBLEMS



7—As corks used in insulated bottles quickly absorb odors from the contents of the bottles, it's a good idea to wrap a piece of clean Cellophane around each cork before inserting it. This will prevent moisture from entering and keep the cork free from odors. 8—One of the simplest ways to wind a roller-spring of a window shade is to insert the flattened end in a keyhole, so that both hands will be left free to grip the roller and turn it until tight



9—If you have kitchen chairs with tubular steel legs that grind dirt into the linoleum, drill and tap the legs for glides of the machine-screw type. They make the chair easy to move and prevent floor scratches



10—Quilting patterns are transferred quickly to a number of blocks with a sewing machine. Just stack and pin several blocks under a master pattern and sew around the outline without thread in the machine. Easy-to-follow perforations will be made on each block. 11—By attaching an extra mirror on the back side of a medicine-cabinet door, you can have access to the shelves while shaving, without opening and closing the door. Four flat-iron brackets fitted with rubber cushions hold the mirror in place. 12—Instead of throwing away a celluloid powder-puff container, you can use it for a string dispenser after punching a hole in the lid



Simple Hand Press for Lapidaries Splits Stones With Ease

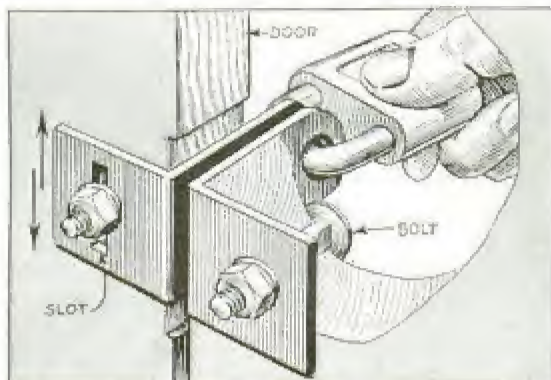


Splitting of stones by amateur lapidaries is made easy by use of two sturdy chisels mounted in parallel pieces of steel and driven together under pressure applied by winged nuts working on threaded bolts. The chisels should be of good quality steel and they should be much thinner than the ordinary cold chisel. The bolt threads should be 8 to 10 to the inch. Also, care should be taken to set the cutting edges of the chisels exactly opposite each other.

—Floyd McCracken, San Diego, Calif.

Improving the Hasp of a Padlock

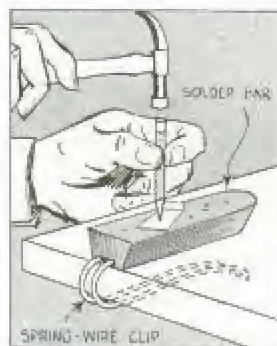
When a hasp of the type shown is used with a padlock, any sagging of the door or settling of the frame will throw the parts out of alignment so that the lock cannot be inserted. If one part of the hasp is removed from the door, and the bolt hole



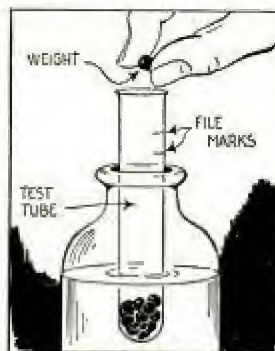
made into a slot, as indicated in the drawing, the part can then be raised or lowered to align with the other one.

Modelmaker's Anvil From Solder

The customary piece of bar solder used by modelmakers as a punching anvil, may be prevented from sliding about or tipping and spoiling a piece of work, by soldering a spring-wire clamp to the underside of the bar. This permits the anvil to be clamped to the edge of the bench.



Test Tube Used as Balance Scale



The bottle should be filled to a certain depth each time it is used, the tube should be graduated with known weights, using a file to mark the glass.

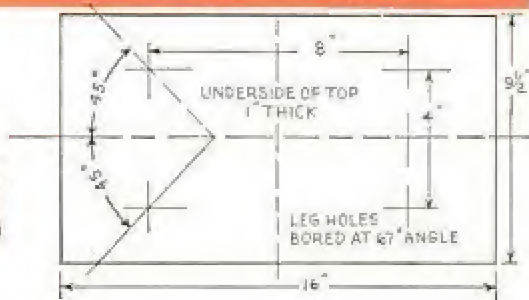
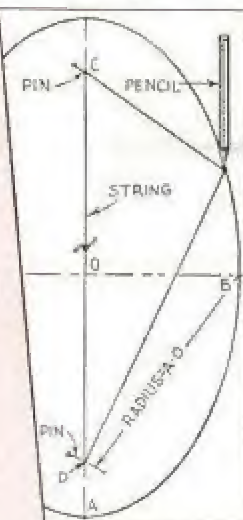
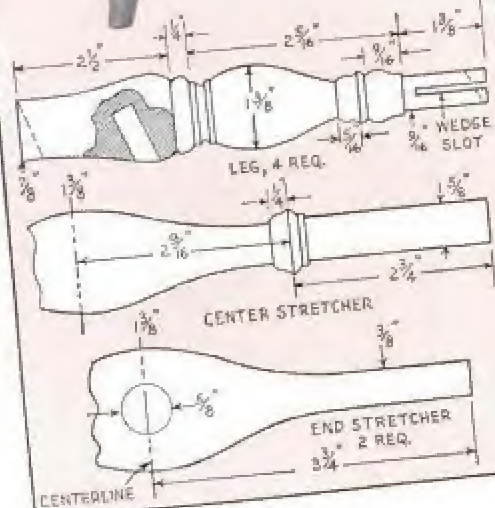
Cellulose Tape Holds Small Parts While Glue Is Drying

The next time you have to glue a small broken piece back on a chair leg or other piece of furniture, try strips of cellulose tape for holding the parts together until the glue dries. The tape is easy to remove and does not mar the wood surface.



Sheet asbestos, covered with oilcloth, makes an ideal pad for the top of your stove, which then can be used as a table.

CRICKET FOOTSTOOL



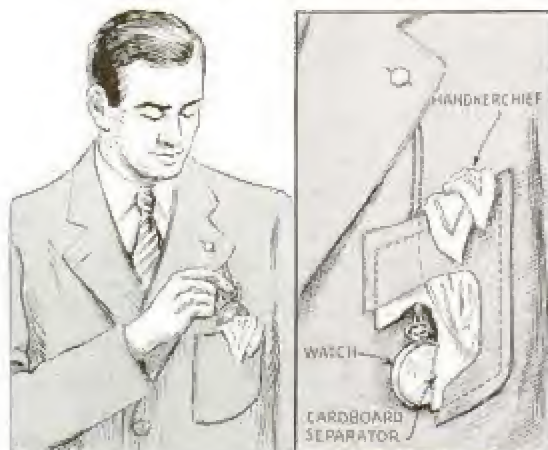
MADE of wood to match your favorite chair, this footstool is just the thing to set off your period furnishings. Construction is simple if care is taken. First, saw out the blanks for the legs and stretchers, and drill the holes in the leg blanks for the stretchers before turning them. Templates will aid in duplicating these parts. Next is the stool top, which is an ellipse. There are several ways of laying out this, one of the simplest being to use a string and two pins as shown in the upper center detail. Two lines are drawn to intersect at their centers, and then positions A and B are located, using radii equal to one half the length and one half the width respectively of the intended ellipse. Then, with a compass set to a radius equal to the distance between A and O, which in this case is 8 in. as the stool top is 9½ by 16 in., positions C and D are located by striking arcs from position B. Pins are put at these

points to take the string, which should be taut when a pencil is placed against it with the point set on position B. The ellipse is drawn by running the pencil around inside the string, keeping it taut at all times. After sawing out the top, holes for the legs are laid out as shown in the lower detail and drilled. The leg tenons are slotted for wedges, after which the stool is assembled with glue, wedges being driven into the leg slots for a tight fit. If the work has been done carefully, clamps will be unnecessary to hold the assembly while the glue dries. After a final sanding with fine abrasive paper, the stool is ready for finishing. This should be done to match the chair at which the stool is to be used.

—Wallace W. Buffmire, Evanston, Ill.

⚠ Gas flames should be turned down when foods begin to boil, as nothing is gained by rapid boiling, and much gas is wasted.

Pocket Separator Between Watch And Handkerchief



If you carry both a watch and a handkerchief in your lapel pocket, a cardboard separator in the pocket between them will enable you to pull out the watch without disturbing the handkerchief. The cardboard is cut to pocket size and short enough so that it cannot be seen.

Opening of Both Cellar Doors Avoided in This Entrance

By making one of the outside cellar doors wider than the other, one home owner made it unnecessary to open both of them



when carrying ordinary articles in or out of the cellar. However, the full width of the cellar entrance is available whenever needed by opening the smaller door.

—A. R. Hazard, Kane, Pa.

❏ Do not set your shrubs too close together just to get an immediate effect. You should consider the size and height the plants will attain at maturity.

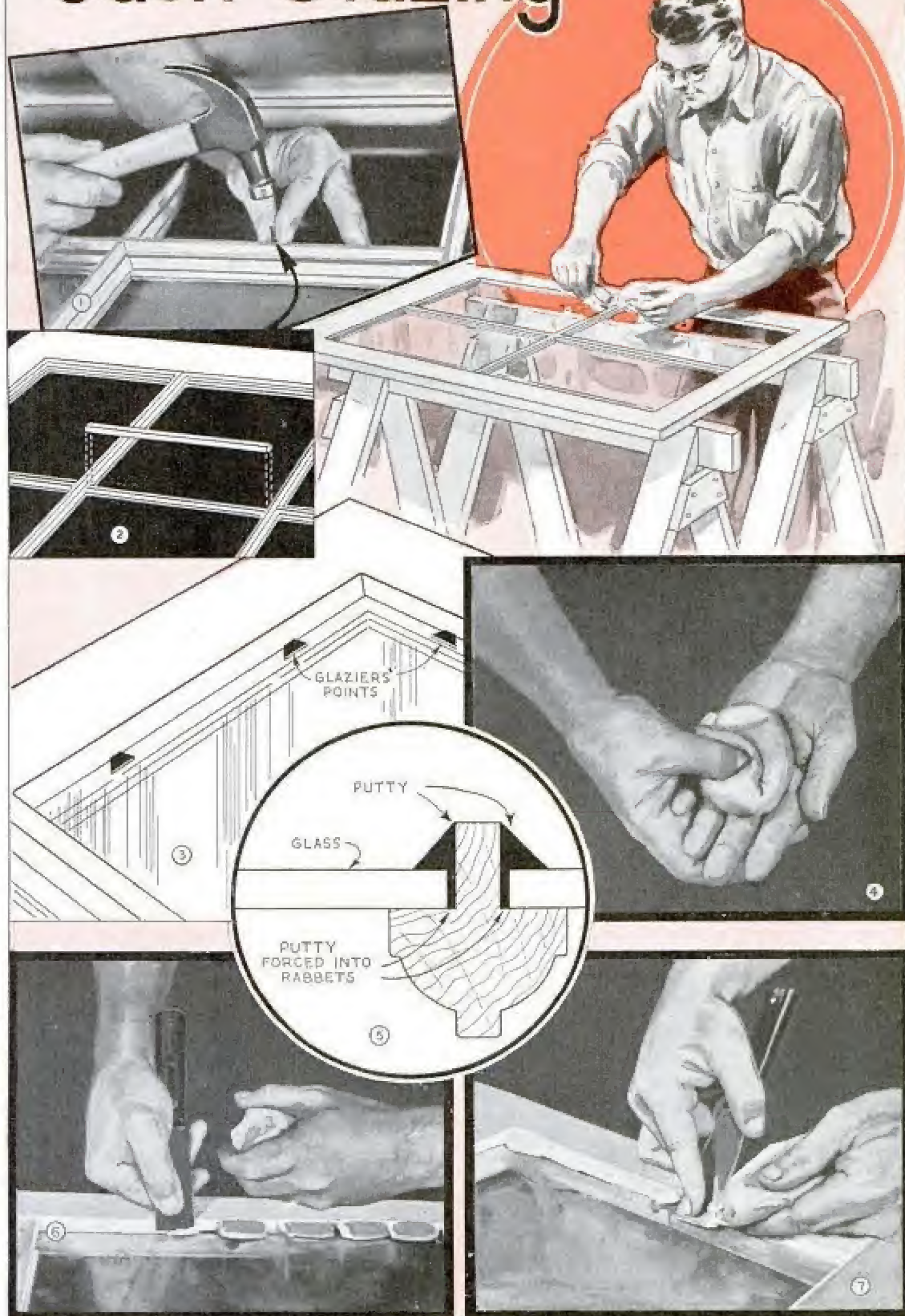
Remember These Points When Glazing Sash

Even in such an easy job as glazing a sash, simple but important details of correct procedure are often overlooked. The first thing that comes up is the condition of the sash frame. If it has weathered for some time and most, or all, of the putty has fallen out, look the frame over carefully for rotted wood, loose joints, and splintered or warped muntins, the latter in a multiple-pane sash. Remove the glass, clean away loose putty, tighten up the frame with bar clamps and secure the loose corners with $\frac{1}{4}$ -in. dowels. These are driven in holes bored at right angles through the tenoned joints. Repair splintered or rotted muntins by cutting away all the old wood to the bottom of the rabbets and putting in strips of white pine as in Figs. 1 and 2. Give the frame a priming coat of paint. Putty will not bond to the bare wood. If the pane, new or old, fits tightly, score it $\frac{1}{16}$ in. or so from the edges with a glass cutter and chip away the waste. The reason for this loose fit is important, as shown in the cross-section, Fig. 5. Note that the putty has been forced in between the edges of the glass and the sides of the rabbet, forming a strong bond and a waterproof joint. After the paint on the frame is thoroughly dry, replace the glass and secure each pane with glaziers' points placed as in Fig. 3. Whether you use a common putty or the new nonhardening putty it should be well worked or kneaded in the palm of the hand, Fig. 4, before being used. In puttying, start as in Fig. 6 by filling the rabbet the full length before smoothing as in Fig. 7. When you make the smoothing strokes, tilt the leading edge of the knife and apply a fairly heavy pressure to force the putty behind the edge of the glass. Allow the putty to dry before painting.

Filling Nail Holes in Tile Board

Builders who have occasion to use low density acoustical tile board on ceilings or walls ordinarily countersink the nails on each corner and then vainly attempt to fill the holes. By gathering small portions of the sawdust from the tile boards that have had to be cut, rolling it into small balls about the size of a buckshot, and gently pushing it into each hole an invisible "puttying" job can be done.

Sash Glazing

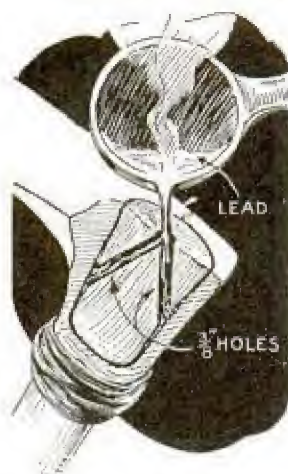


Pipe Spreader Converts Boat Oars Into Convenient Carrier



Slipped over the locks of a pair of boat oars, a short length of pipe will keep them spread so that they can be used for carrying bundles and boxes of camp equipment. When carrying the oars, a tendency to pull them together should be maintained to prevent the pipe from slipping off the locks.

Tool Handle Led in Place



Handles that have a tendency to loosen in tools can be kept tight by this method: Drill from the center of the end of the handle diagonally to both sides, trimming the handle down so that it is a very loose fit in the tool. Then pour molten lead into the holes, wrapping a cloth or piece of rubber around the lower part of the tool head to retain the lead. Be very careful when pouring to avoid air bubbles which might cause the lead to spurt out of the hole and burn you.

—H. J. Priehs, Miami, Fla.

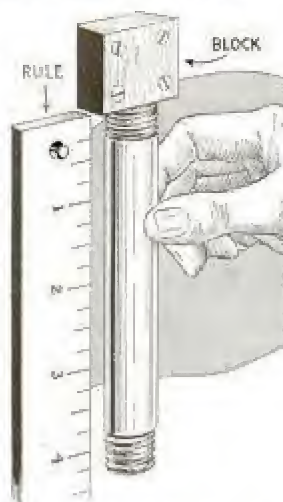
Easy Way to Destroy Wasps Before Painting Building

When painting houses, barns, etc., and you want to get rid of large nests of hornets, bees, wasps, etc., under the overhang

of a roof, weight a piece of cord with a large washer and then throw the cord over the building so that you can have access to each end of the cord. A piece of spiral-shaped flypaper may then be attached to the cord and hauled up alongside of the nest. If the nest is then struck with a pole or stone, the insects will rush out and stick to the flypaper. The few which do work loose will be unable to fly and will fall to the ground where they may be killed.

Stop Block Beside the Yardstick Helps Measure Short Work

You can measure short dowels, bolts, etc., without removing a yardstick or rule from its peg on the wall. Just screw a block to the wall so that its lower edge is flush with the end of the yardstick, as indicated in the drawing. In this way, all you have to do is butt the work to be measured against the stop block, after which a glance at the lower end will show you its length.



Four Doorstops Raise Chair Seat For Tots at the Table



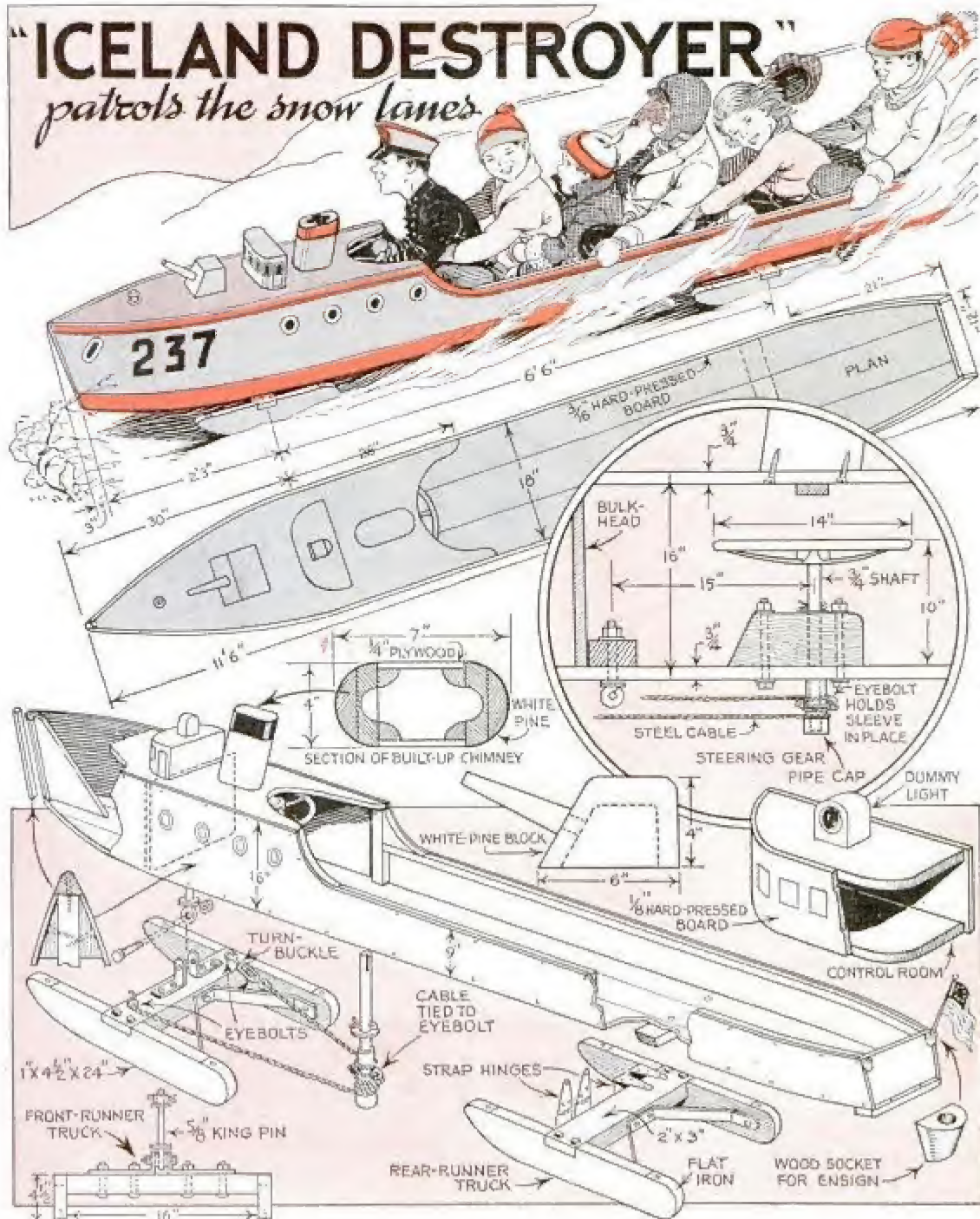
If you have a child that has outgrown the high-chair, but is still too small to sit comfortably at the table on an ordinary chair, four rubber-tipped doorstops screwed into the chair legs will solve the problem. It's a good idea to drill pilot holes for the screws to avoid splitting the legs.

The chair is handy also, to use at the kitchen sink or work table.

—A. H. Waychoff, Phoenix, Ariz.

"ICELAND DESTROYER"

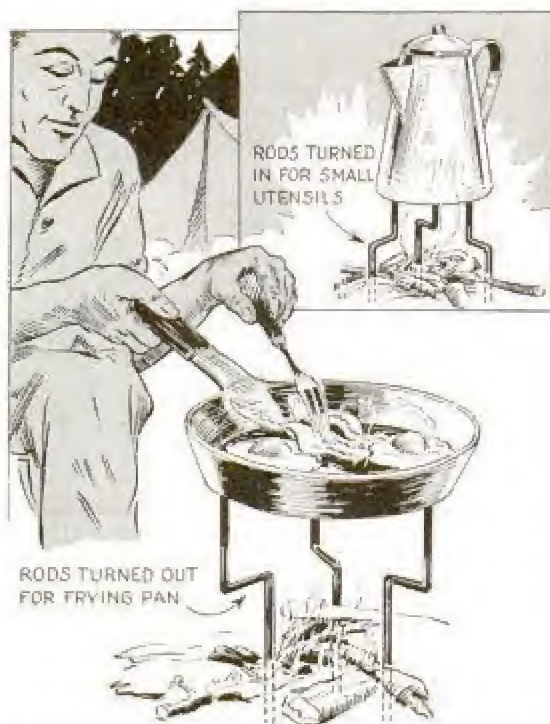
patrols the snow lanes



Built on a conventional bobsled chassis and having a body simulating a destroyer hull painted in gray with a red water line, this novel coaster will be a sensation on any hill. It consists mainly of thin but strong hard-pressed board, it is sturdy without excess weight, and will not splinter in case of a collision. The bottom and frame for the foredeck are made of $\frac{3}{4}$ -in. stock. Spruce strips running along the gunwales reinforce the hard-pressed board at these

points. There should be a half-round rub rail on the outside. Steering is arranged in the usual manner, and the steering wheel should be smaller than a standard auto wheel. The funnel is built up of white-pine pieces glued together and trimmed to a curve, with plywood for the sides. Control room is made as shown, and the gun turret is hollowed and trimmed from one block of white pine. Ensigns can be mounted in the twin sockets on the transom.

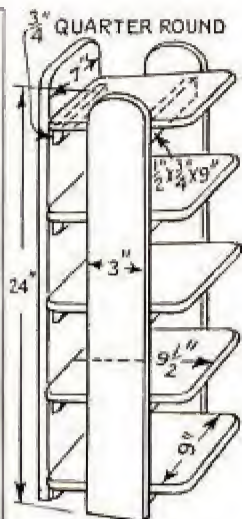
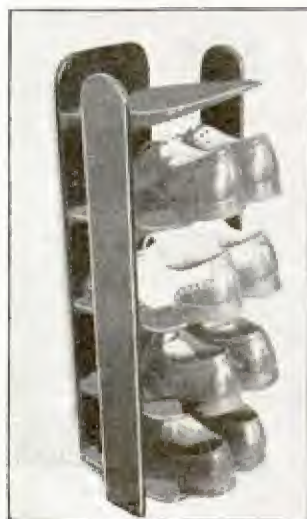
"Camp Stove" From Steel Rods Is Easy to Carry



Consisting of three steel rods, this utensil support is easy to carry and enables you to cook over an open fire. The rods are bent to form offsets, and are adjusted to suit large or small utensils by turning the rods in or out as indicated.

Simple Rack for Your Shoes Takes Little Space

If you want a shoe rack that takes little space and can be made inexpensively, this one is just the thing. The sides and back

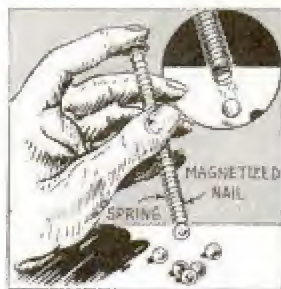


are $\frac{1}{2}$ or $\frac{3}{4}$ -in. solid stock and the shelves are $\frac{1}{4}$ -in. plywood. A couple of coats of enamel provide a good finish. If the edges of the plywood shelves have cracks or holes in them caused by faulty core in the plywood, fill them with glue and sand them smooth before painting.

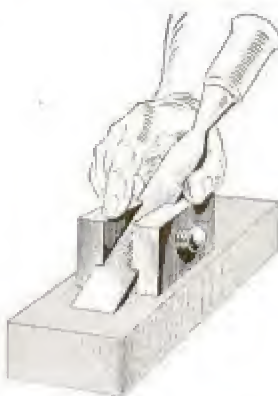
—H. Skalla, Berlin, N. J.

Assembling of Small Ball Bearings Aided With Magnetized Nail

Small ball bearings or other steel parts may be handled easily for assembly work by means of a magnetized nail and a coil spring. The spring, which is of a size to just fit over the nail, is stretched so it is slightly longer than the nail. Held as shown, the nail is pushed out of the spring to pick up a bearing, which is then pushed off the nail end by releasing the spring.



Chisel Held at Angle for Honing By Grooved Blocks



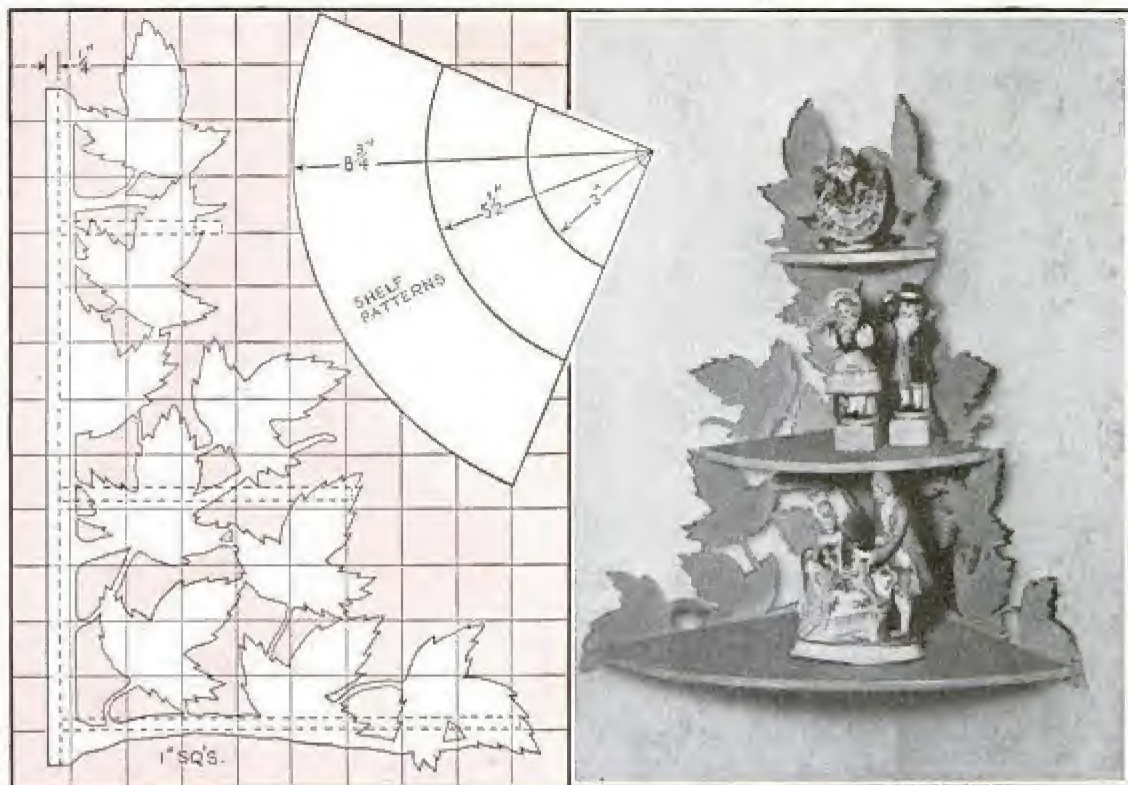
To hold a chisel at the correct angle for honing on an oilstone, this simple gauge block is just the thing. It consists of a pair of blocks with grooves cut at the correct angle in which the chisel rests. The blocks are held together by means

of a bolt with a coil spring under the head. When the bolt is tightened, the blocks are pressed firmly against the edges of the chisel, holding it at the correct angle for honing.

CASH FOR UNUSUAL IDEAS

We pay cash for outstanding ideas showing simpler and better ways to do daily tasks, shortcuts in shop work, darkroom aids, household hints, auto kinks, etc. Send a good photo or sketch and a concise but full explanation of your idea to the Homecraft Editor, Popular Mechanics, 200 East Ontario Street, Chicago.

A Corner Whatnot Shelf in Maple-Leaf Design



Just the thing to dress up a corner in your living room, this whatnot shelf has duplicate plywood sides that can be cut together. However, one must be $\frac{1}{4}$ in. wider than the other at the back edge. After sanding thoroughly, the sides are assembled with glue and small brads, and the

shelves are spaced as indicated on the squared drawing. Finishing the original shelf to carry out the maple effect consisted of applying maple oil stain, followed by a coat of white shellac. When the shellac was dry, the surface was sanded, dusted clean and given a coat of clear varnish.

Auto-Casing Pads Ease Strain of Carrying Heavy Packs



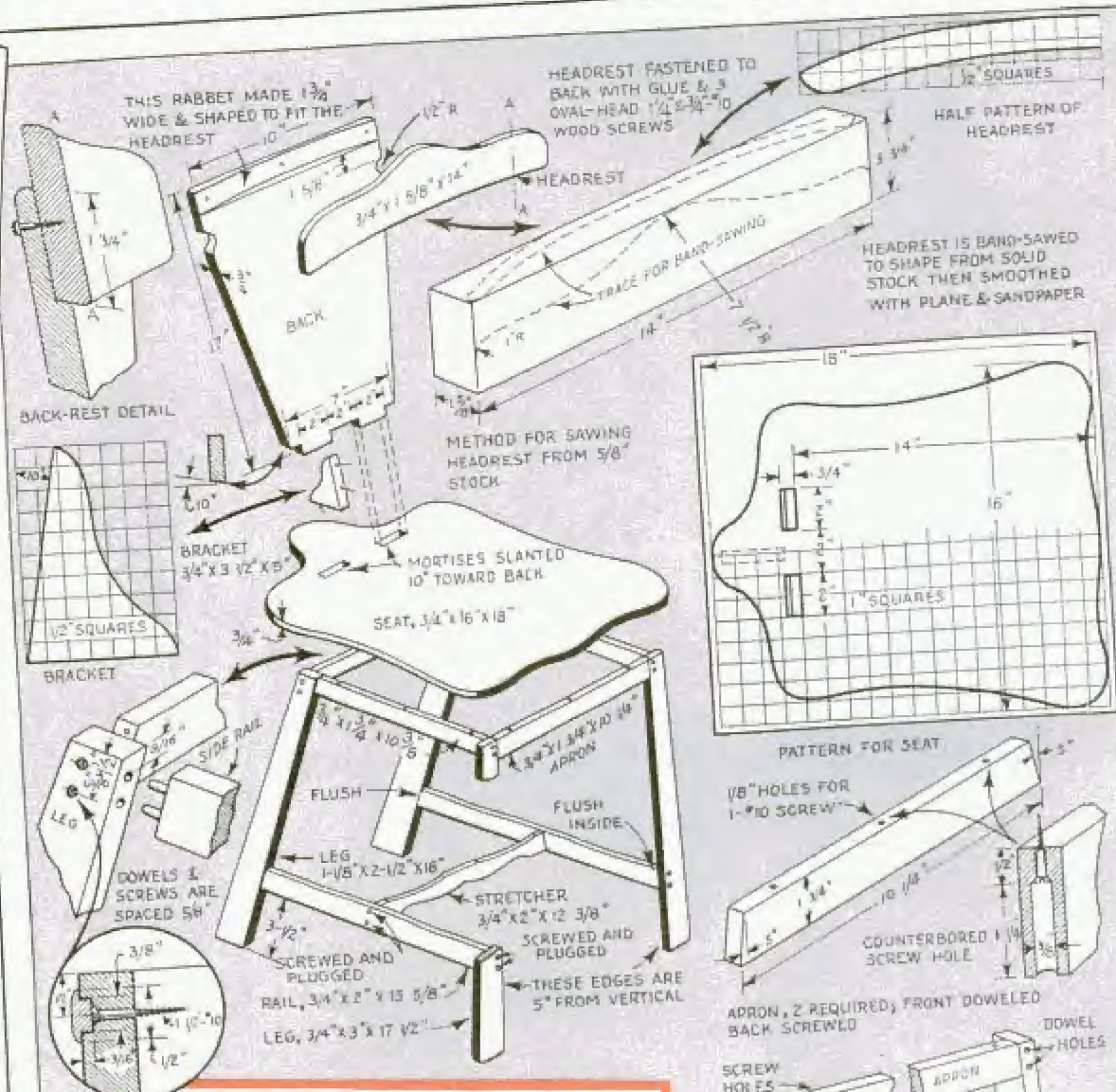
You can carry a heavy pack in comfort for long distances if the weight is distributed over both shoulders by a couple of pads cut from an old auto casing. These are slotted on both sides and threaded on the straps as shown. The pads fit comfortably and prevent the straps from rubbing.

Putty Can Sealed by Machine Oil

Putty will remain fresh if the can is kept sealed. This is done by merely dropping a little machine oil in the cover groove of the can before closing it.



Leather-Covered GAME



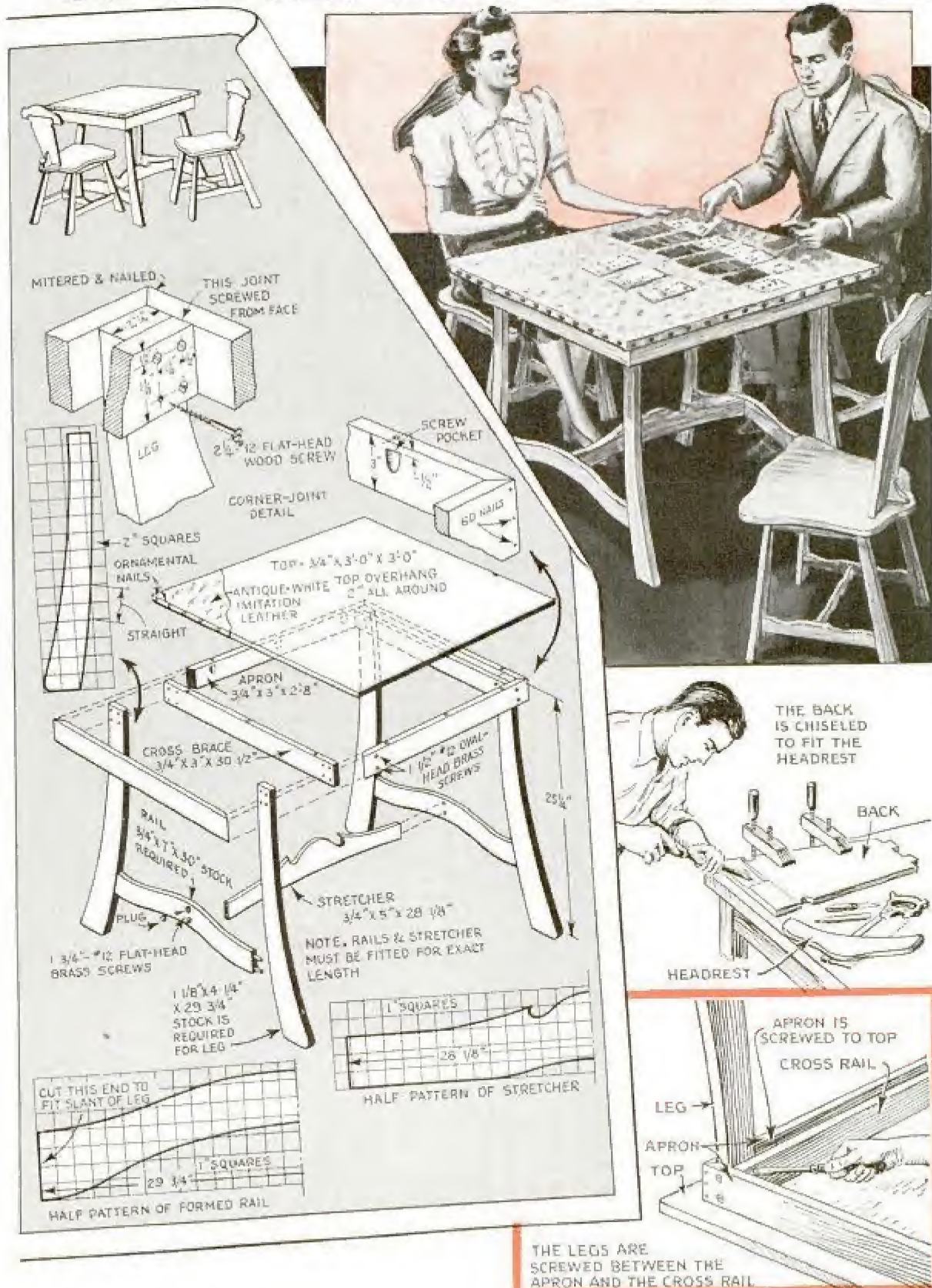
MATERIAL LIST—CHAIR

- 1 pc. $\frac{3}{4}$ x 16 x 18 in.—Poplar or birch—Seat (Glued up)
- 1 pc. $\frac{3}{4}$ x 10 x 17 in.—Poplar or birch—Back
- 1 pc. $\frac{3}{4}$ x 1 $\frac{1}{2}$ x 14 in.—Poplar or birch—Head rest
- 1 pc. $\frac{3}{4}$ x 3 $\frac{1}{2}$ x 5 in.—Poplar or birch—Bracket
- 2 pcs. $\frac{3}{4}$ x 1 $\frac{1}{4}$ x 10 $\frac{3}{8}$ in.—Poplar or birch—Side aprons
- 2 pcs. $\frac{3}{4}$ x 1 $\frac{1}{4}$ x 10 $\frac{1}{4}$ in.—Poplar or birch—Back and front
- 2 pcs. $\frac{3}{4}$ x 2 x 13 $\frac{3}{8}$ in.—Poplar or birch—Rails
- 1 pc. $\frac{3}{4}$ x 2 x 12 $\frac{3}{8}$ in.—Poplar or birch—Stretcher
- 2 pcs. $\frac{3}{4}$ x 3 x 17 $\frac{1}{2}$ in.—Poplar or birch—Front legs
- 2 pcs. 1 $\frac{1}{2}$ x 2 $\frac{1}{2}$ x 16 in.—Poplar or birch—Back legs

MATERIAL LIST—TABLE

- 1 pc. $\frac{3}{4}$ x 36 x 36 in.—Plywood—Top
- 4 pcs. $\frac{3}{4}$ x 3 x 32 in.—Poplar or birch—Apron
- 2 pcs. $\frac{3}{4}$ x 3 x 30 $\frac{1}{2}$ in.—Poplar or birch—Brace
- 4 pcs. 1 $\frac{1}{2}$ x 4 $\frac{1}{4}$ x 29 $\frac{1}{4}$ in.—Poplar or birch—Legs
- 2 pcs. $\frac{3}{4}$ x 7 x 30 in.—Poplar or birch—End rails
- 1 pc. $\frac{3}{4}$ x 5 x 28 $\frac{1}{2}$ in.—Poplar or birch—Stretcher

or BREAKFAST TABLE



House Number Part of Railing Around Front Porch



Shaped from iron and worked in as part of the railing on a porch, your house number adds a novel touch to the porch and is easy to see from a distance. The present vertical members of the railing can be sawed off and the numbers welded to them. Shape the numbers from iron of the same size as that used in the railings.

—Axel E. Ogren, Chicago.

Plastic Dish on Balance Scale Aids in Weighing Chemicals

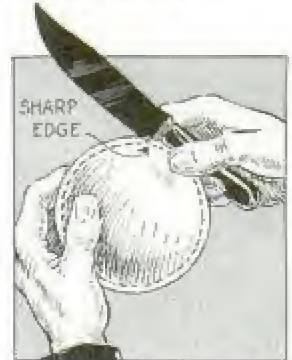
A small plastic dish will make the weighing of chemicals easier. Just remove the pan used for chemicals and substitute the dish. Of course, the scale must be re-balanced. A dish of this kind eliminates the use of a paper cover, which most ama-



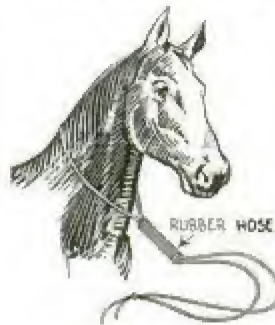
teurs use on their chemical pan to prevent scratches. Also, it makes possible the weighing of larger amounts of chemicals at a time.—Kenneth Kenna, Amsterdam, N. Y.

Heel of Paring Knife Sharpened To Cut Orange Skins

Orange skins can be cut so they are easy to peel, without cutting into the fruit, if the sharpened heel of a paring knife is used for the purpose as shown. To cut an orange skin, merely rotate it under the knife handle against the sharp heel of the blade.—Edward Woniger, Algiers, La.



Lead Rope Is Made Adjustable By a Piece of Rubber Hose



If you have horses and other animals to lead around, a rope like the one shown will come in handy. In use, the rope is looped over the animal's neck, after which a short piece of

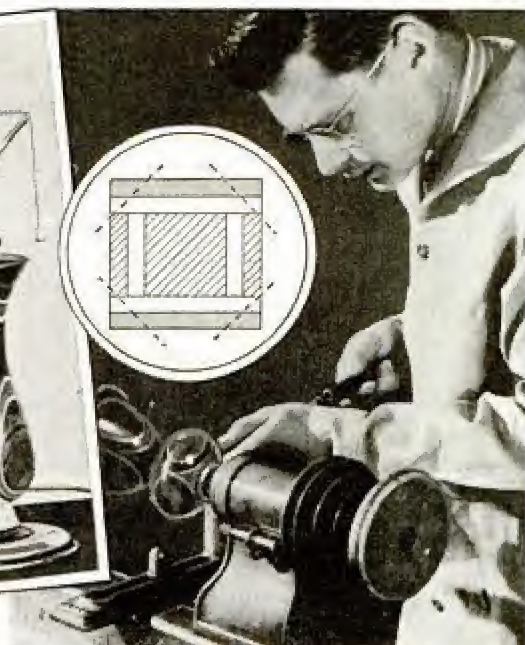
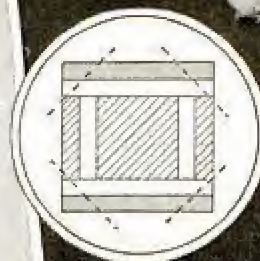
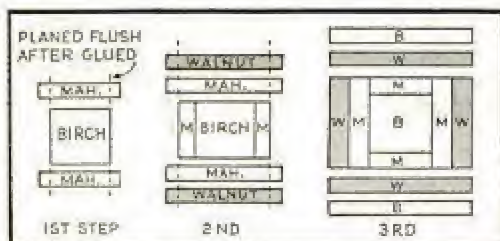
hose is slipped up to keep the looped portion in place. The hose should be of a size to be a snug sliding fit over the rope.

Ruling Squared Paper Quickly

It takes only a few seconds to rule a large sheet of paper into squares of equal size for enlarging patterns, if you use five short pencils in a holder of the type shown. It is merely a strip of corrugated cardboard, in which the pencils can be spaced to rule squares of different sizes.



How to Make Attractive Variegated Turnings



Beautiful wood turnings in various shades of color for lamps, vases, etc., can be made by gluing up turning blanks of contrasting wood blocks. To make a blank for the lamps shown, start with a 1½-in. square of birch wood and glue ¼-in. mahogany to opposite sides. After the glue has dried, square the block and add a piece of ¼-in. mahogany and ⅛-in. walnut to each of the remaining sides. Square these edges and to each of the first pieces of mahogany glue ⅛-in. walnut and ⅛-in. birch. This process is continued, varying the color and thickness of the laminations added until all sides have the same number of laminations. Only one layer can be glued the first time. After that, glue two at a time. The reason for this is that each square must be completed without a lap of different wood at the corner. Different effects are obtained by varying the number, thickness and color of the laminations.

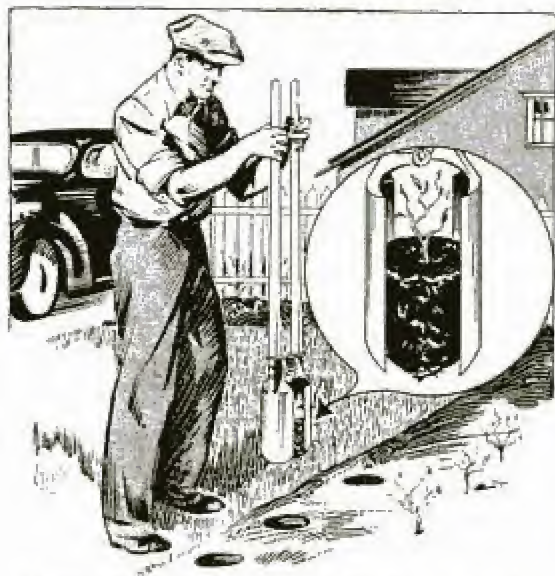
Typewriter Silenced to Avoid Disturbing Others at Night

For those who have to type late at night or under other conditions where noise of the typewriter is likely to be disturbing, the following methods of silencing the machine will be helpful. First of all set the typewriter on sponge rubber pads to dampen vibration. Then use a piece of fabric under the paper in the machine to deaden the noise of the keys. Fabric such as 11-oz. boat-sail drill having a high thread count is preferable.—Allen Fiske, Chicago.

☛ A common clothespin, split in half lengthwise, will make two pan scrapers which will not rust or scratch aluminum.



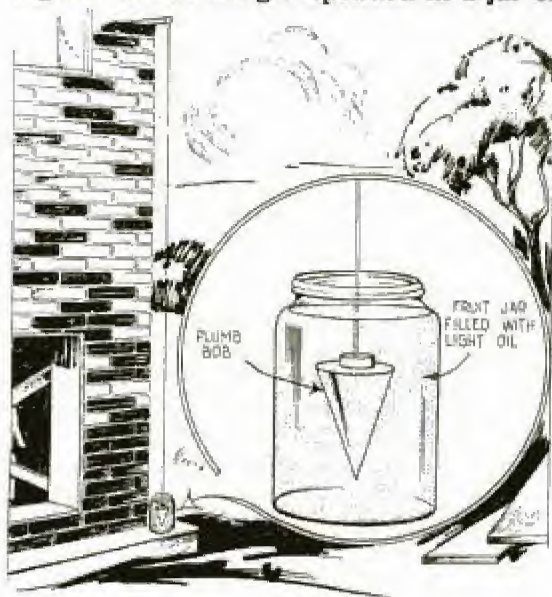
Seedlings Transplanted Quickly With a Post-Hole Digger



You can transplant tiny bushes and other seedlings easily with a post-hole digger of the type shown. With it, the work can be done quickly and without disturbing the plant root system any great amount. First, make the holes where the seedlings are to be transplanted. Then, with the jaws of the digger opened, set them down hard astraddle the plant and lift it out. It is a good idea to wet the soil around the seedlings to help prevent crumbling.

Jar of Oil Steadies Plumb Bob

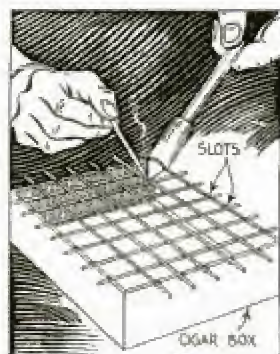
When using a plumb bob on a long cord on a windy day it can be steadied by allowing the bob to hang suspended in a jar of



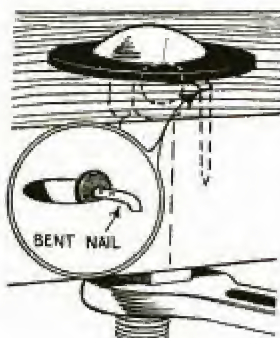
light cylinder oil. The clearest oil possible should be used so that you can see the point of the bob for marking.

Wires Spaced for Soldering To Make a Grill

Having a number of wire grills to make, one tin-smith sawed shallow slots in the sides of a cigar box to hold the wires in the desired positions while soldering them. The slots must be spaced the same distance apart as the distances between the wires in the completed grill.



Carriage Bolt Kept From Turning By Head of Nail

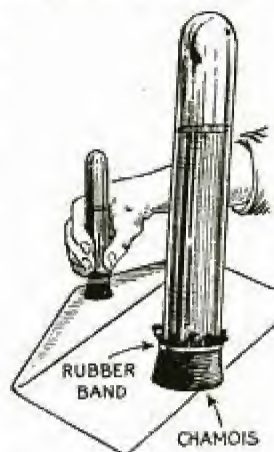


To prevent carriage bolts from turning in wood, one craftsman drives a short nail near the edge of the hole and then bends it over so that the head provides one straight side for the shoulder of the bolt to

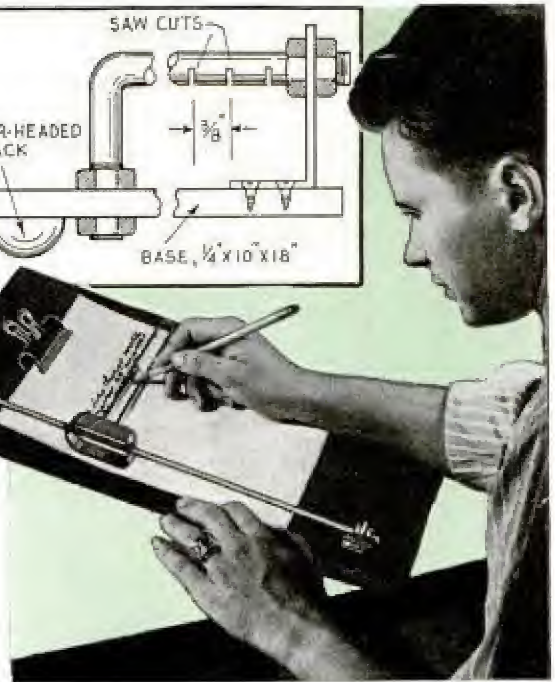
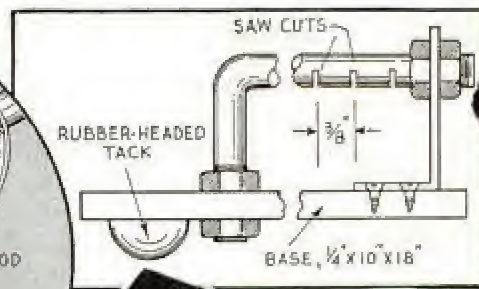
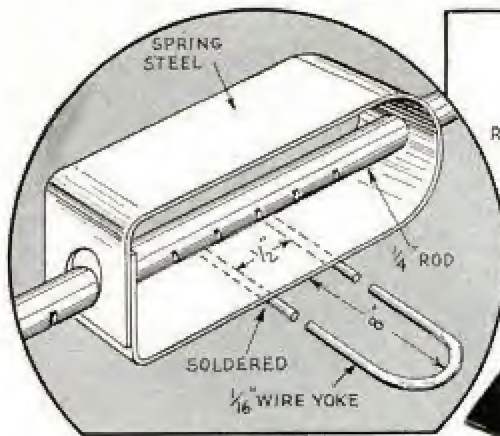
rest against. Under ordinary strain, this will keep the bolt shank from turning.

Test-Tube Envelope Moistener

In an emergency, you can make a handy envelope moistener from a test tube. Just fill it with water and bind a piece of chamois over the end with a rubber band. Be sure that the band fits tightly to avoid leaks when the tube is turned upside down in use.



Letter Board Has Pencil Guide for Blind Person



Persons who have given up letter writing on account of failing eyesight will appreciate this board as it enables them to write straight lines at uniform spacing from the edges of the sheet without any trouble. It consists of a plywood base, a notched rod along the left edge and a pencil guide, the latter being attached to a spring-steel clip which fits on the notched rod. In use, writing is done inside the pencil guide, while the left forefinger is used to mark the end of each word before lifting the pencil.

When a line is completed, the guide is moved down one notch which automatically puts it in position for the next line.

—Edwin Hicks, Indianapolis, Ind.

Simple Finishing Touches Dress Up the Backyard Swing

Instead of just bolting the top crosspiece of a swing to the uprights in the usual manner, why not give it a finishing touch



of neat workmanship and improve its appearance? This can be done by carefully pointing the ends of the crosspiece and tops of the uprights, and then half-lapping the joint so that the pointed ends will just cross each other. Two 3/8-in. bolts at each joint, one locked with an extra nut, will hold the parts together rigidly. Before assembling, apply white lead on the joints to prevent water from soaking into the wood.

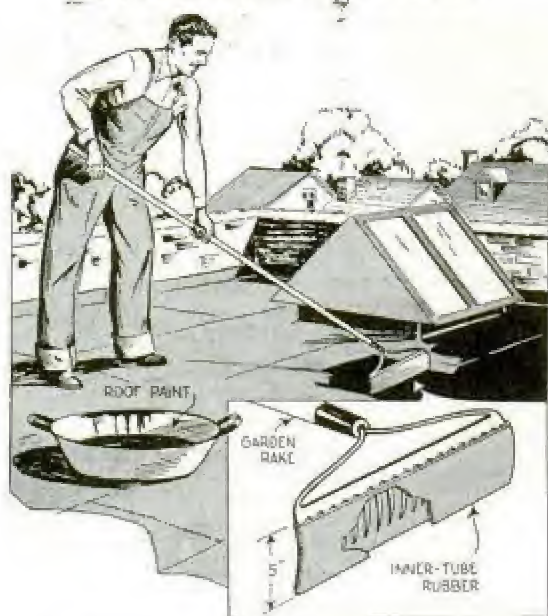
"Aged" Wallpaper for Patches

After papering a room, I always save a strip of the paper and hang it in the attic to use for repair purposes. This allows the strip to "age" the same as paper in the room so that a perfect repair job can be made at any time necessary.

—Charles Latour, Jr., Albany, N. Y.

☛Olive or vegetable oils should be stored in the refrigerator after they have been opened, as they are apt to become rancid unless they are kept chilled.

Rubber Band Over Garden Rake Used as Roofing Brush



While applying paint or tar to composition roofs, one workman found that a garden rake with a wide rubber band cut from an inner tube and stretched over the teeth made a good spreader. The rubber should extend beyond the lower ends of the rake teeth so that the rake can be used as a squeegee.

Inset Borders Ruled on Showcards With Curtain Rod

To rule inset borders on showcards and price tickets, one artist uses a length of metal curtain rod. This is tacked to the top of the work table and the cards are inserted in the groove as shown, while the brush is drawn along the inside edge to paint the lines quickly and uniformly.



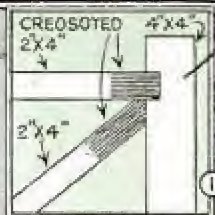
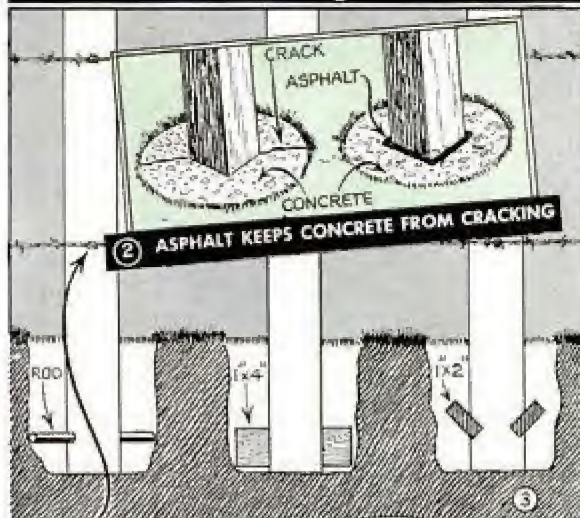
How to Build Good Fences

Much of the disappointment experienced in seeing a good fence, on which you have spent money and labor, deteriorate in a few years can be avoided if a few simple precautions are observed when building it. Posts will rot underground in a short time unless you use some method to avoid rot, such as the application of creosote. Brushing it on helps, but soaking the posts in the liquid is more effective. Setting wood posts in concrete will cause the latter to crack just as surely as water freezes. Expansion caused by moisture in the post freezing causes the trouble. For a permanent installation, wrap a layer of corrugated cardboard, smooth on one side only, around the posts, and later remove this and pour in hot asphalt. The latter provides an expansion joint between the concrete and post. When posts have to be set so that the pull of the wire will tend to lift them, rods or wooden blocks near the lower ends make good anchors. Old harrow disks screwed to the posts will prevent lifting.

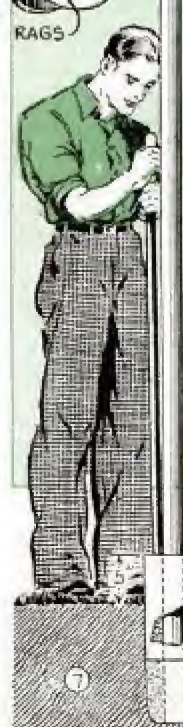
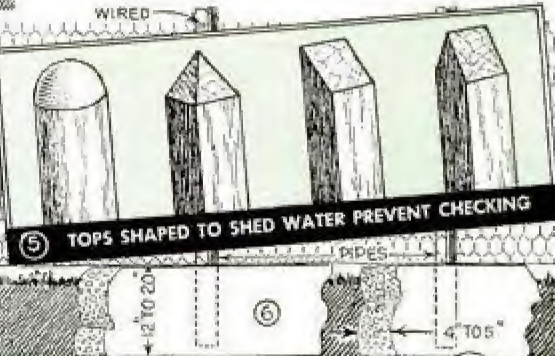
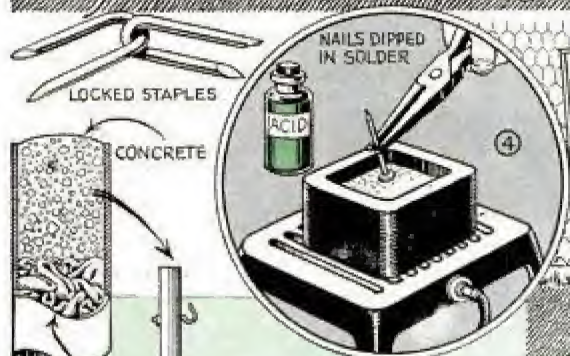
Rounding or beveling the tops of the posts does more than make them attractive. It prevents water from soaking in and greatly retards checking of the wood which would cause it to rot rapidly. Dry rot of joints in wood fences can be minimized by creosoting the ends of the timbers or beams where they contact. Where pipes are used for clothesline supports, you can set them in concrete. Use a piece of stovepipe as a form, letting it project above the ground 4 or 5 in. After the concrete has set, the stovepipe is cut away above the ground. The tops of the pipes can be closed with concrete to keep out water. To do this, rags are stuffed into the pipes a few inches below the tops to retain the concrete until it hardens. Pipe set in a concrete wall makes ideal supports for woven wire. The concrete is poured into a trench in which the pipe has been placed and plumbed. Boards should be used as forms above the ground to produce a neat appearance. Nails or screws used above ground in constructing a wooden fence can be tinned by dipping them in molten solder to retard rust and to prevent rust stains on the wood. Using two staples locked together will hold barbed wire firmly in softwood posts.

❗ Damp berries mold quickly so do not wash them until they are ready to be used.

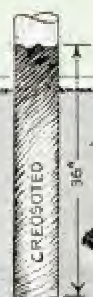
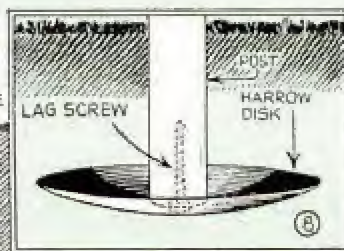
Hints on building Sturdy Fences



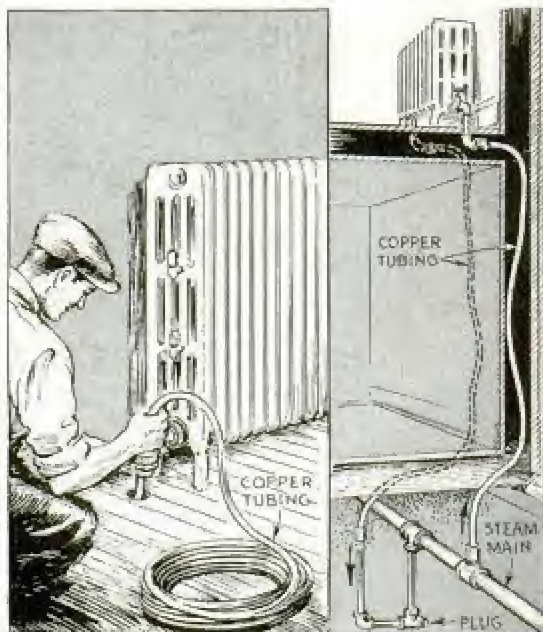
1—Creosoting wood-to-wood joints above ground retards dry rot, but if you paint over the creosote it is likely to "bleed" through the paint. 2—It's a waste of time to set wood posts in concrete unless you pour a layer of asphalt between the wood and concrete to provide an expansion joint



3—Posts anchored in this manner will "stay put" if the earth fill is tamped around them. 4—Tinning nails in molten solder prevents rust and its resulting stains on wooden fences. 5—Beveling or rounding post tops drains off water and helps prevent rotting. 6—Pipe set in underground concrete wall to make permanent lawn or poultry-yard fence. 7—Large pipe clothesline supports last indefinitely if set in concrete and plugged with the same material to keep water out of the tops. 8—Harrow disk used to prevent lifting of posts. 9—Many years of life are added to posts if they are protected against rotting underground by soaking them in creosote. The posts should remain in the liquid for several hours. The creosote coating should reach 5 or 6 in. above the ground



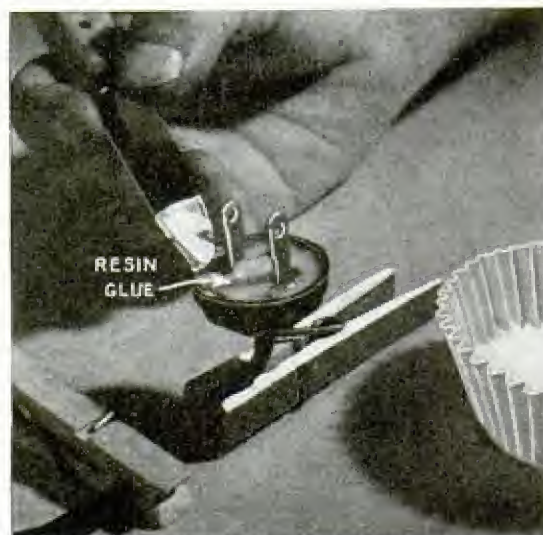
Piping for Radiator Concealed By Using Copper Tubing



One of the disadvantages in providing steam heat for a house already built—that of concealing the piping running to the second floor—can be overcome by using copper tubing instead of pipe. In most cases, the tubing can be “fished” up between the walls with little trouble as it is bent easily. Regular pipe fittings are available for copper tubing so that it can be connected to the radiators and pipes.

Sealing Wires in Outlet Plug

Fraying and pulling of the wires from a male plug of an electric extension cord can be prevented by filling the cavity of the



plug with plastic or resin glue. It will be necessary to plug the hole around the cord with paper to prevent the plastic from running out before it hardens.

Dishes Marked With Nail Polish When Used on a Picnic

The next time you go on a community picnic or dinner where your dishes are likely to be mixed with others so that it is difficult to identify them, mark them with fingernail polish. Dishes marked in this way can be washed without removing the identifying mark, yet the polish can be taken off with polish remover.



Crease in Felt Hat Reinforced To Prevent Excessive Wear



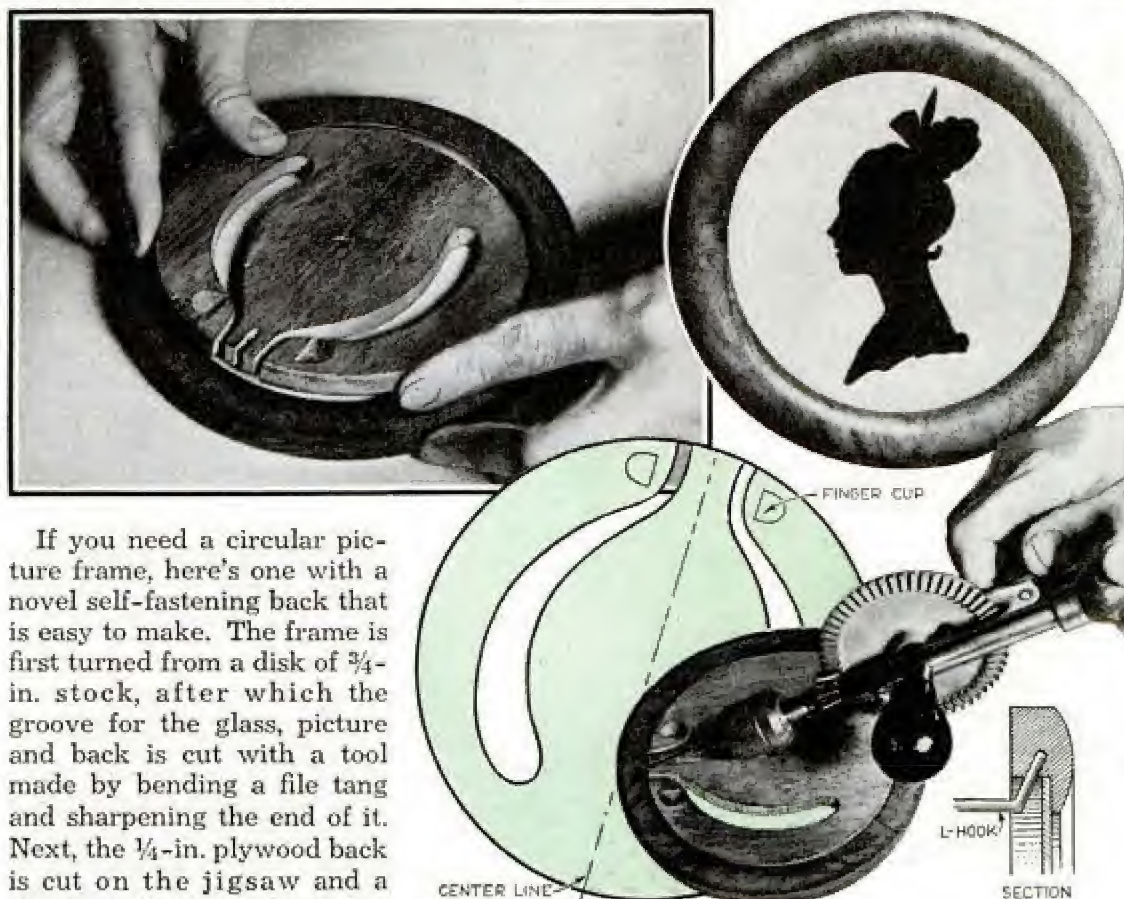
Excessive wear and cracking of the felt in a hat where the crown is creased can be avoided by reinforcing the portion to be creased with small strips or pieces of soft leather. This is attached inside the hat with rubber cement so that it can be removed for cleaning and blocking the hat.—Allen Fiske, Chicago.

Bobby Pins Make Good Clamps For Modelmakers' Use

Simple clamps for holding small parts together while gluing or fitting can be made in a few minutes from bobby pins by bending them as indicated. The clamps are opened easily by applying a little pressure to the bent side of the pin.



Turned Picture Frame Has Self-Fastening Back



If you need a circular picture frame, here's one with a novel self-fastening back that is easy to make. The frame is first turned from a disk of $\frac{3}{4}$ -in. stock, after which the groove for the glass, picture and back is cut with a tool made by bending a file tang and sharpening the end of it. Next, the $\frac{1}{4}$ -in. plywood back is cut on the jigsaw and a chisel or knife is used for making the two finger cups. To insert the back in the frame, you merely press it in

place as shown. The frame hangs on an L-hook which slips in hole drilled at an angle.

Bicycle Holder Folds Flat Against Wall When Not in Use



Instead of just leaning your bicycle against the garage wall where it might slip down, it's a good idea to provide a folding holder of the type shown. It is merely a section of old auto casing fastened to a pivoted arm that is bolted to a stud.

Weather Strips on Stepladder Hold Small Paint Cans

To prevent small cans of paint from sliding off a stepladder, one sign artist uses a couple of pieces of weather stripping to hold the cans in place. Both strips are tacked at an angle so that the cans wedge between them.



BUILDING "Starlet" - A MODEL YACHT of the Sharpie Type

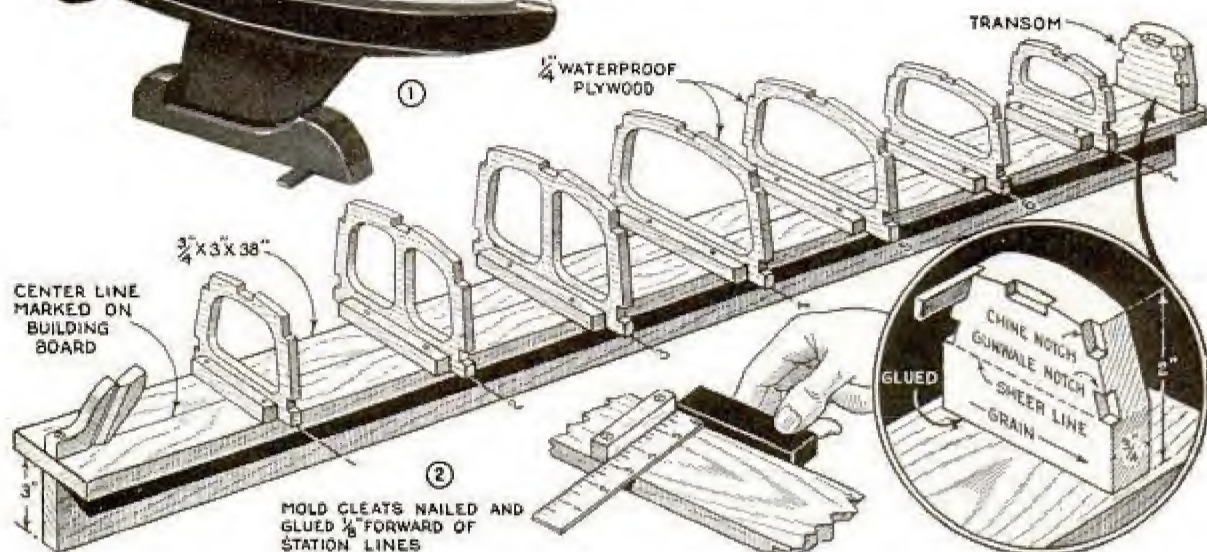
By John Black

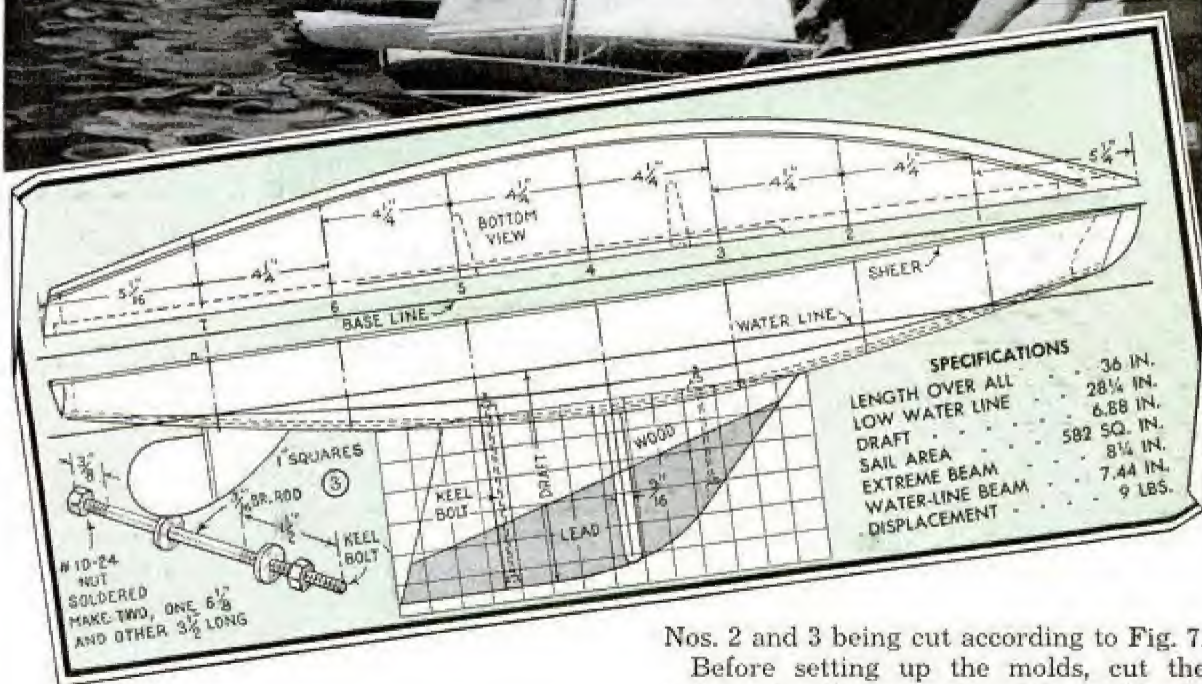
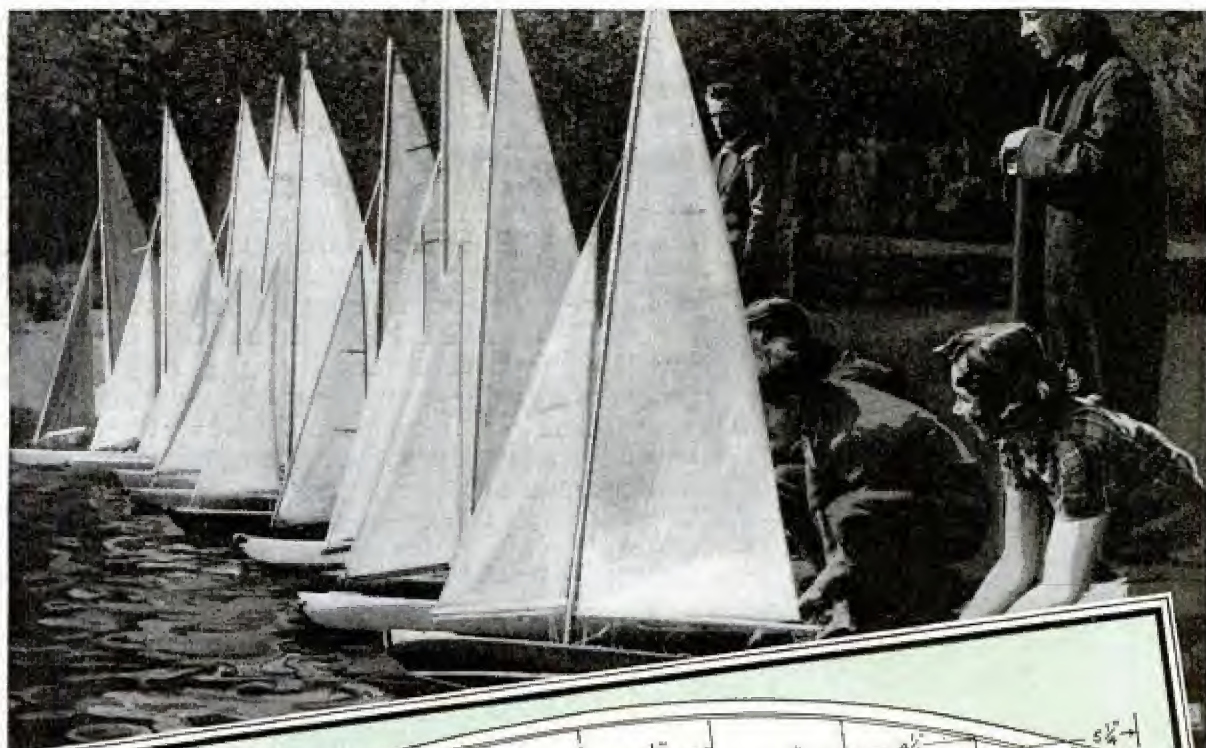
Ex-President, International Model Yacht Racing Union



"STARLET" is a 36-in. model racing yacht that you'll find easy and inexpensive to make. The completed model is shown in Fig. 1.

You begin by making the two-piece building board as detailed in Fig. 2. One edge of this should be planed straight and true and used in squaring the station lines across the top. Fig. 3 gives the correct spacing of the seven lines. Next, $\frac{1}{2}$ -in. square cleats to which the molds are to be fastened, are glued and nailed $\frac{1}{8}$ in. forward of the station lines so that the molds will center on the lines. All seven molds can be cut from a $\frac{1}{4}$ by 5 by 48-in. piece. Fig. 4 gives full-size, half-breadth patterns of each mold which you can transfer through onto thin paper and then to your wood. Trace only the side and bottom outlines and mark on each respective pattern the point where the side line stops at the sheer. From the sheer point on, each pattern is drawn to extend to the base line. (See Fig. 7.) Before you can lay these out on your wood, each pattern must be reduced $\frac{1}{8}$ in. along the side and bottom because the outlines given are to the outside of the planking. In tracing around the patterns, be careful to keep the base line even with the edge of the wood. When you get the molds cut out, mark the deck crown on each one. For this you will



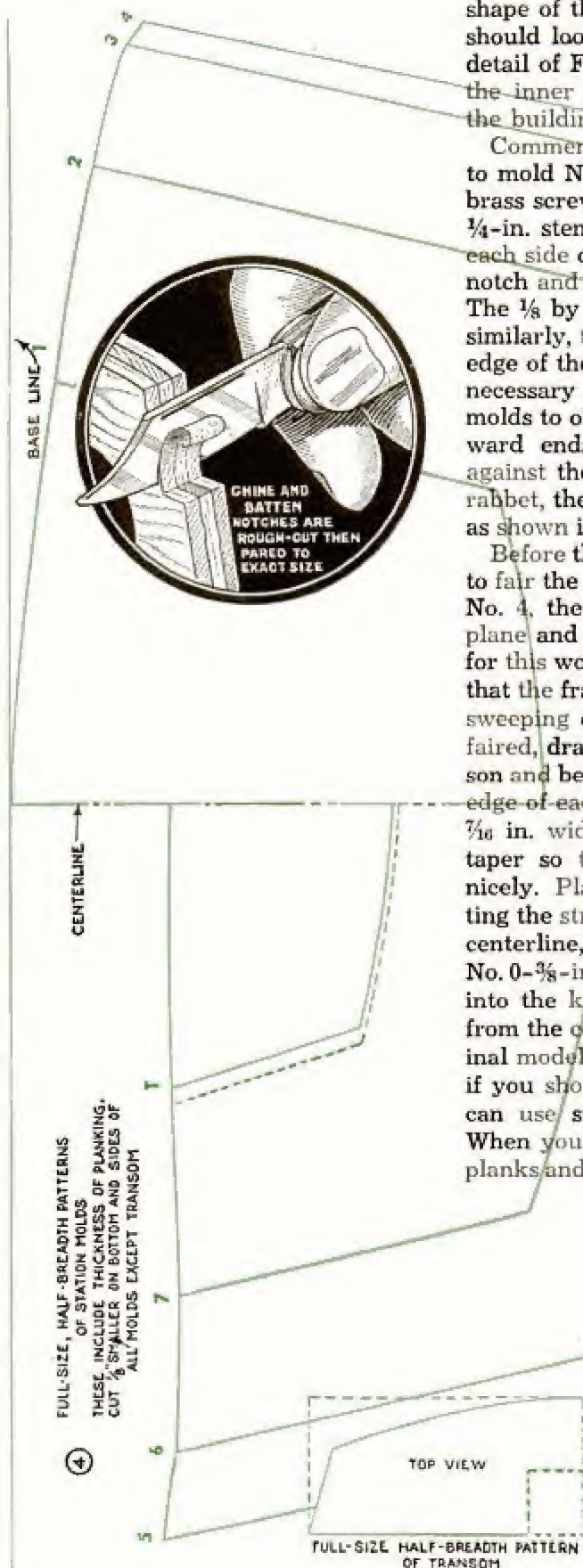


need a cardboard template like the one shown to the right of Fig. 8. This one template is used to mark all molds. Place it on the work so that the curve will be even with the sheer points when the centerlines of both mold and template coincide, and then mark the curve. As this line likewise represents the outside of the deck planking, a second line must be drawn $\frac{1}{8}$ in. in from the first. Now, referring to Fig. 7, you will see that a saw cut is made slightly above this second line and stopped about 1 in. from each side. This cut is made to simplify cutting the hull free of the building board. You will notice also that the center portion of the molds are cut out,

Nos. 2 and 3 being cut according to Fig. 7.

Before setting up the molds, cut the notches for the gunwale, chine and keelson. Make these slightly undersize so that they can be trimmed later to exact size. With a centerline marked the length of the building board, glue and brad each mold to its respective station cleat.

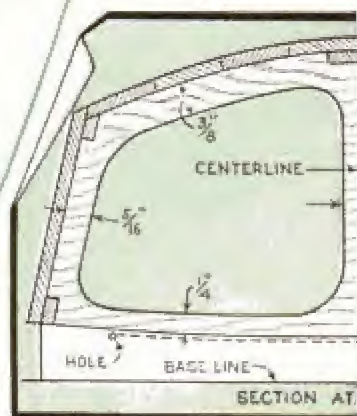
While these are drying, you can cut out the stem and transom. Fig. 6 gives a full-size pattern of the stem for tracing on a $\frac{5}{8}$ -in. block. The planking rabbet can be cut now, or later. In the latter case, be sure to mark the rabbet line on both sides of the block. To mark off the shape of the transom, refer to Fig. 4 and copy the full-size patterns given for the stern and top view. Follow the dotted line in sawing the stern outline, the solid line represents the



shape of the inner face. When cut, the transom should look like the one shown in the circular detail of Fig. 2. Run the notches $\frac{1}{4}$ in. in from the inner face and then center and glue it to the building board.

Commence fitting the $\frac{1}{8}$ by $\frac{3}{4}$ -in. keelson flush to mold No. 4 and fasten it with a No. 0- $\frac{3}{8}$ -in. brass screw. Hold the forward end down in the $\frac{1}{4}$ -in. stem notch and mark with a knife along each side of the keelson across each mold. Then notch and fasten. Fit the aft end the same way. The $\frac{1}{8}$ by $\frac{5}{16}$ -in. chines and gunwales are fitted similarly, trimming the notches parallel with the edge of the mold. In some cases you may find it necessary to set the chine in farther on some molds to obtain a nice sweeping curve. The forward ends of the chines and gunwales butt against the sides of the stem at the base of the rabbet, the chines coming flush with the keelson as shown in Fig. 5.

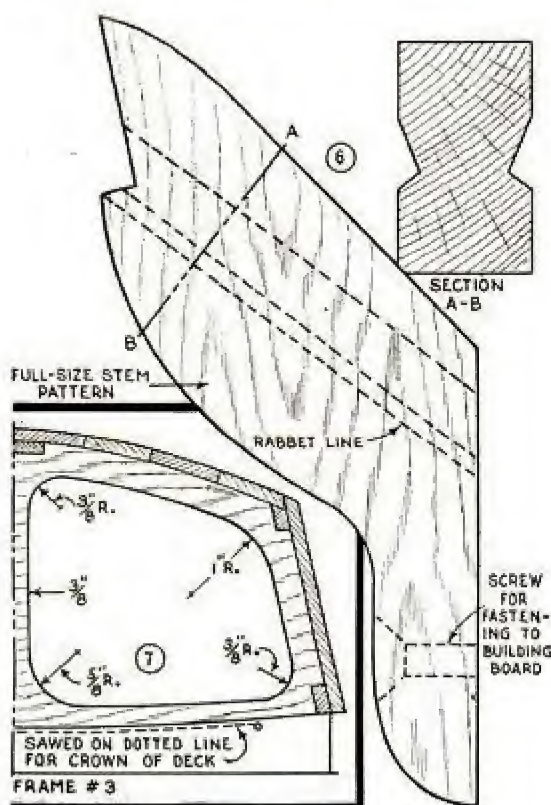
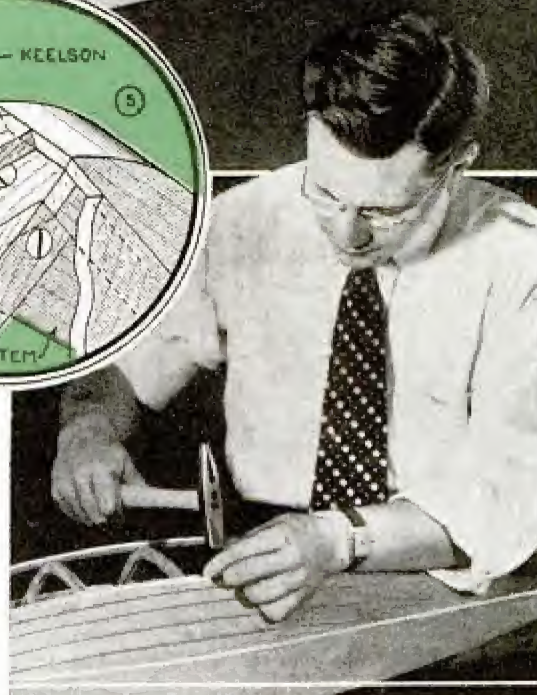
Before the planking can be applied, you'll have to fair the edges of the molds, forward and aft of No. 4, the chines and transom. A small block plane and a coarse wood file will be found best for this work. The important point here is to see that the framework is symmetrical to give a nice sweeping curve to the planking. With the hull faired, draw a line down the center of the keelson and begin fitting the two middle planks. One edge of each plank is tapered from the center to $\frac{1}{16}$ in. wide at the ends. Make this a gradual taper so that each succeeding plank will lay nicely. Place the planks over the keelson, butting the straight edges together directly over the centerline, and fasten the ends to the stem with No. 0- $\frac{3}{8}$ -in. brass screws. Then drive two screws into the keelson, between each mold, $\frac{1}{8}$ in. in from the center joint. The planking on the original model was held with tiny brass screws, but if you should find these difficult to obtain, you can use small brass escutcheon nails instead. When you are satisfied with the fit, remove the planks and re-lay them in waterproof glue. Con-





tinue working from both sides of the centerline in laying the remaining bottom planks which all measure approximately $\frac{3}{4}$ in. wide. Fasten each plank to each mold with two screws, or nails, and coat the butting edges generously with glue.

To make the side planks fit properly, you will have to fair the edges of the outer planks flush with the chines. Fit the side planks to the stem rabbet first and fasten each plank with three brass screws. At the transom, use two screws, placing them be-



low the deck line. Along the chine and gunwale, two screws are used between each mold. When dry, remove the surplus glue and dress down the bottom planks to a smooth surface.

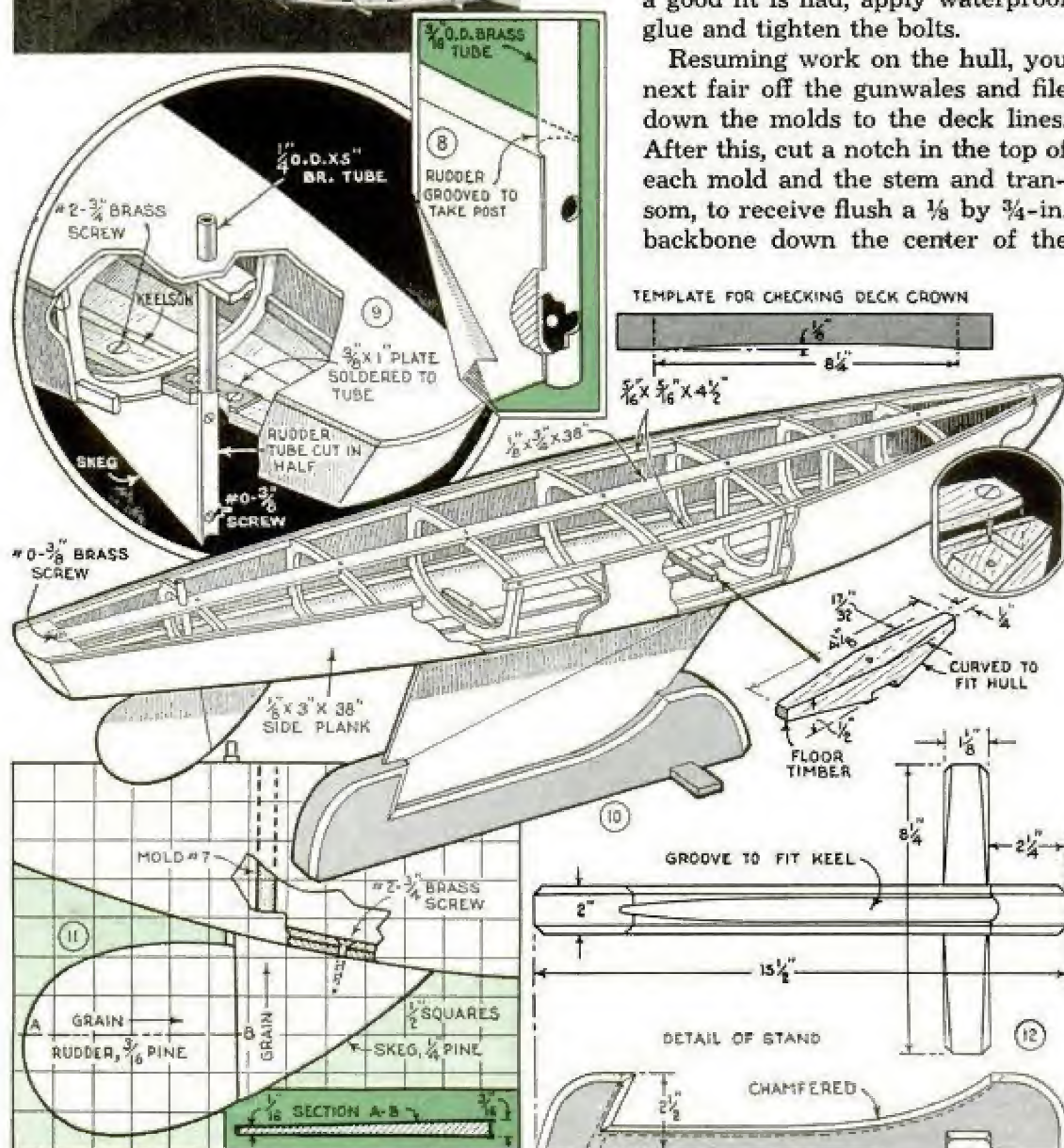
The shape of the two-part keel can be enlarged full size from the squares given in Fig. 3. To cast the lead part, a mold is required which you build up from three pieces of stock, the center piece being cut to the shape given in Fig. 13. When cast, the top edge is planed straight and square, after which the positions of the keel bolts are marked in the center of the top and bottom edges. (See Fig. 3.) Now center-punch and drill $\frac{3}{16}$ -in. holes, drilling from each edge to keep the hole running straight. At the bottom these are counterbored for the bolt heads. The wood half is similarly drilled and then the two are assembled as a unit for final shaping. Round the forward and bottom edges and then with the keel clamped flat, taper the aft edge to $\frac{1}{8}$ in. thick from a point 2 in. in on each side. Fit, glue and plumb the wood part of

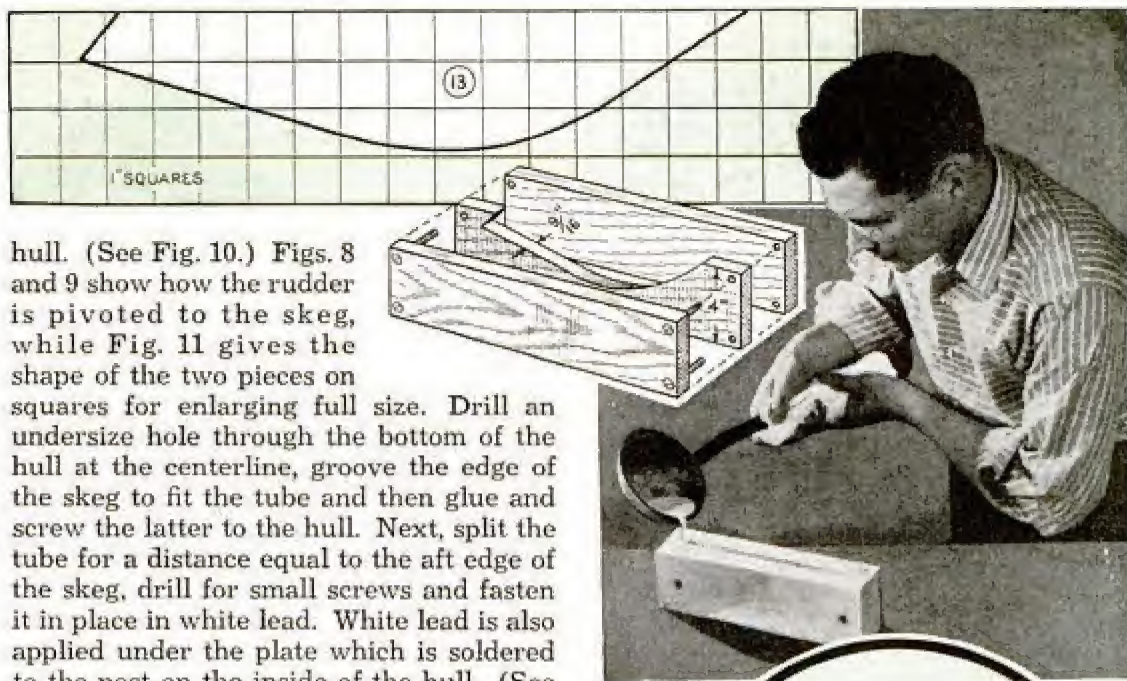


the keel exactly over the hull centerline.

From here on the work will require the hull to be in an upright position. Start cutting it loose from the building board by sawing in from the edge to meet the saw cut previously made in each mold. Cut the transom off $\frac{1}{8}$ in. above the deck line and remove the screw in the stem. Fig. 12 details the stand which is shaped and grooved to correspond with the lower edge of the keel. Over each keel-bolt hole through the hull, you next fit a floor timber like the one shown in Fig. 10. Notice that the aft timber butts against the forward face of mold No. 5 to which it is glued. (See Fig. 3.) These timbers give a solid surface for drawing the keel firmly to the hull. When a good fit is had, apply waterproof glue and tighten the bolts.

Resuming work on the hull, you next fair off the gunwales and file down the molds to the deck lines. After this, cut a notch in the top of each mold and the stem and transom, to receive flush a $\frac{1}{8}$ by $\frac{3}{4}$ -in. backbone down the center of the





hull. (See Fig. 10.) Figs. 8 and 9 show how the rudder is pivoted to the skeg, while Fig. 11 gives the shape of the two pieces on squares for enlarging full size. Drill an undersize hole through the bottom of the hull at the centerline, groove the edge of the skeg to fit the tube and then glue and screw the latter to the hull. Next, split the tube for a distance equal to the aft edge of the skeg, drill for small screws and fasten it in place in white lead. White lead is also applied under the plate which is soldered to the post on the inside of the hull. (See

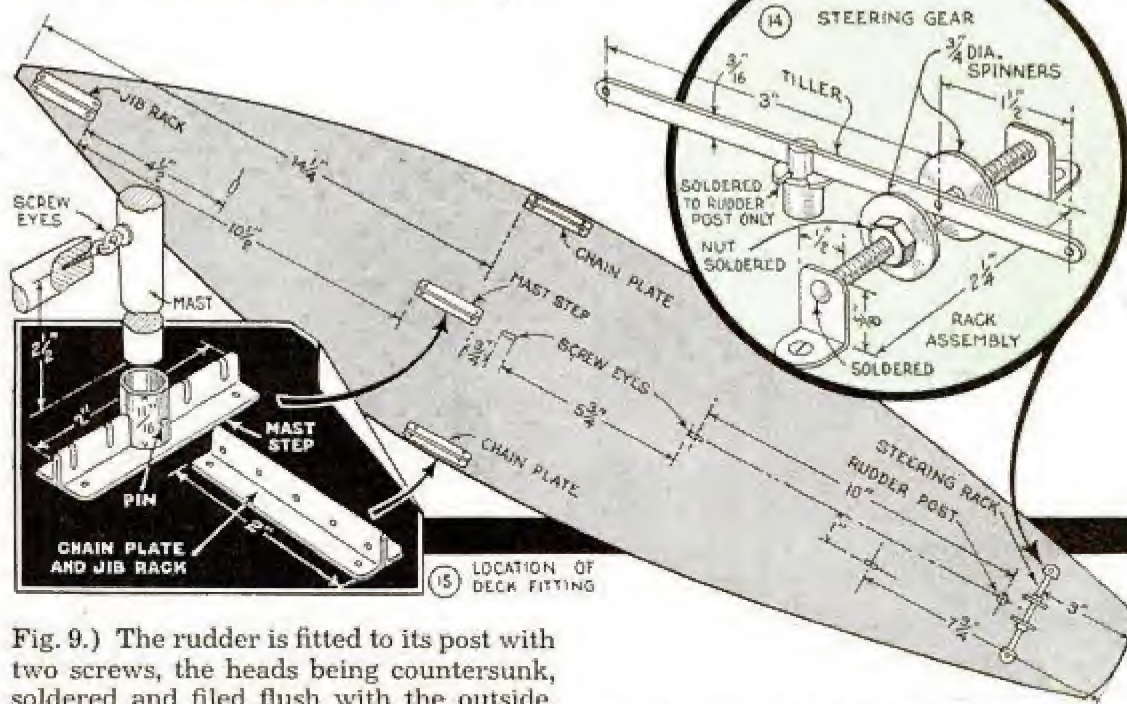
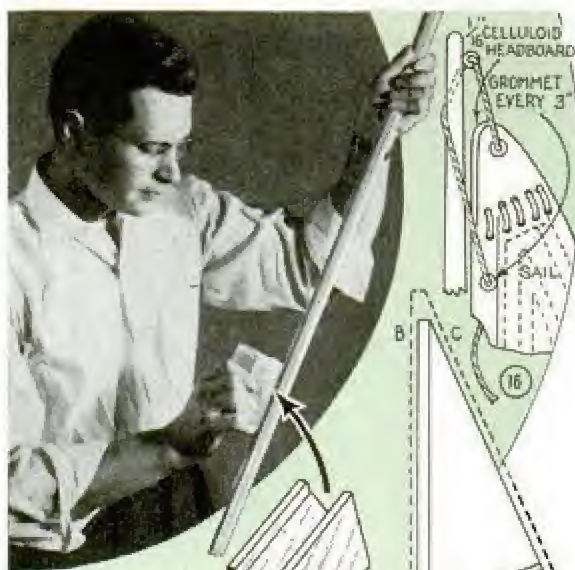


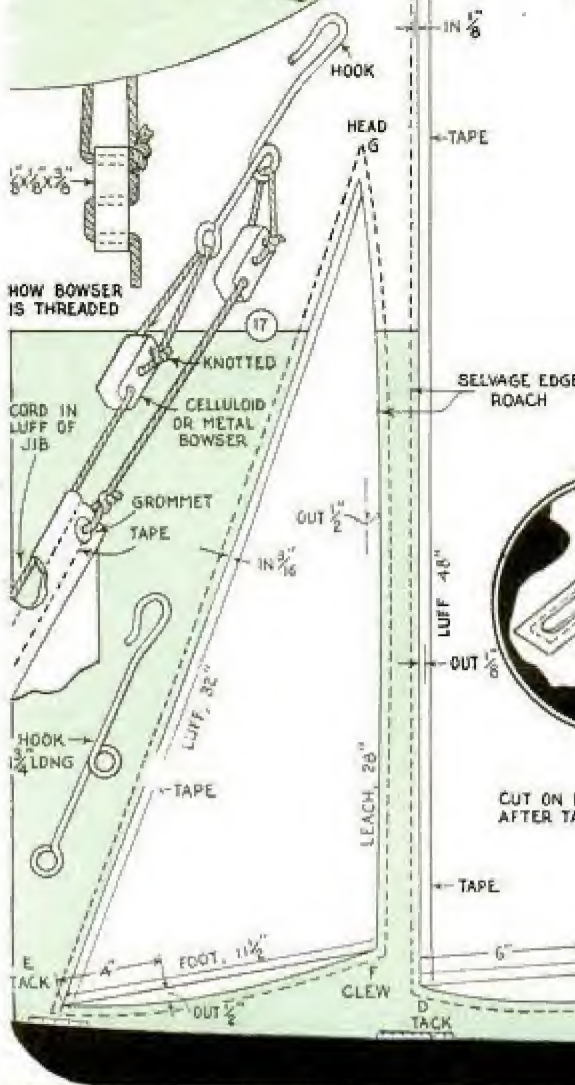
Fig. 9.) The rudder is fitted to its post with two screws, the heads being countersunk, soldered and filed flush with the outside.

To lay the one-piece deck, drill your $\frac{1}{8}$ -in. wood to fit over the projecting rudder tube and fasten it temporarily for marking. Cut the piece $\frac{1}{16}$ in. oversize so that you can later trim it flush with the sides. Prior to laying the deck in white lead, the underside of it, as well as the inside of the hull, should be given three coats of paint or varnish. Also, don't forget to add the pieces to the gunwales between molds 3 and 4. Set all screw heads just below the surface and fill with plastic

wood. Figs. 14 and 15 detail the fittings and the deck plan shows you where they go. The mast step and chain plates are bent from thin sheet brass to stand about $\frac{1}{4}$ in. high, and the tiller arm, Fig. 14, is pinned and soldered $1\frac{1}{2}$ in. from the forward end. The nut-faced spinners travel on a No. 6-32 threaded rod. Use straight-grain pine or spruce for the mast, boom and jib club shown in Fig. 19. First cut the pieces square, tapering the ends as indicated, and then form them round by planing off the

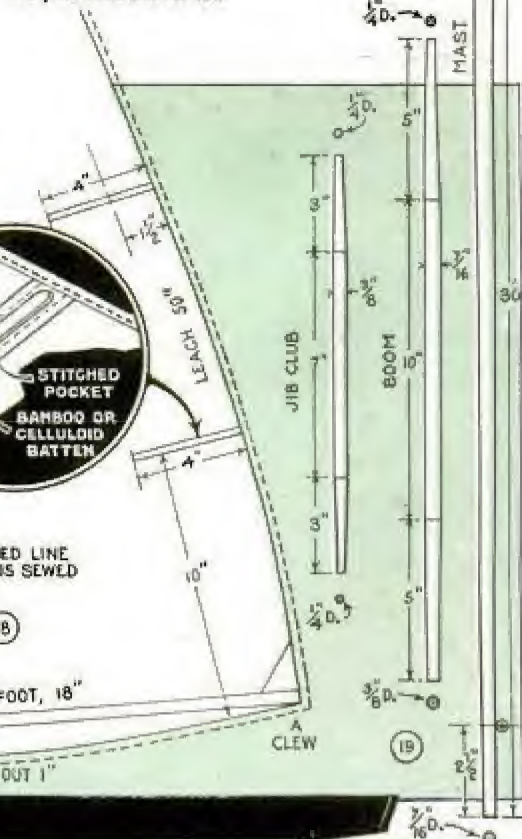


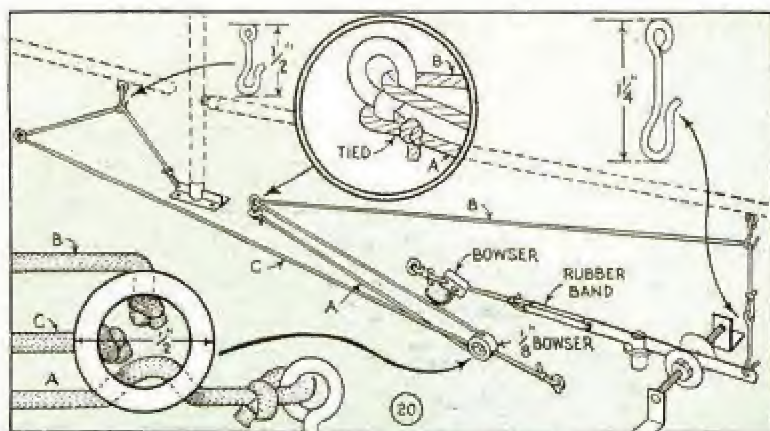
SANDING BLOCK



MATERIAL LIST

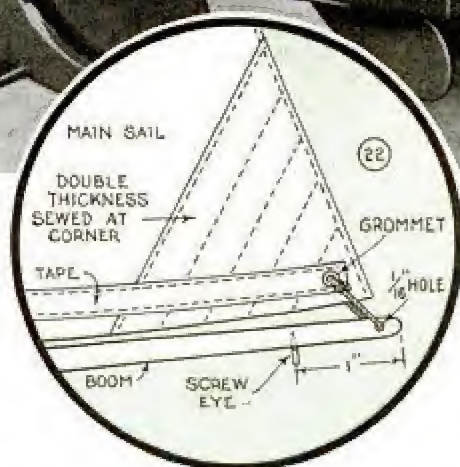
- 2 pcs. $\frac{3}{4}$ x 3 x 38-in. pine, building board
- 1 pc. $\frac{1}{4}$ x 5 x 48-in. waterproof plywood, molds
- 1 pc. $\frac{3}{8}$ x 2 x 4-in. pine, stem
- 1 pc. $\frac{3}{4}$ x $2\frac{1}{4}$ x $3\frac{1}{2}$ -in. pine, transom
- 7 pcs. $\frac{1}{2}$ x $\frac{1}{2}$ x 6-in. pine, cleats for molds
- 1 pc. $\frac{1}{8}$ x $\frac{3}{8}$ x 38-in. pine, keel
- 2 pcs. $\frac{1}{8}$ x $5/16$ x 38-in. pine, chines
- 2 pcs. $\frac{1}{8}$ x $5/16$ x 38-in. pine, gunwales
- 2 pcs. $\frac{1}{2}$ x $\frac{3}{8}$ x 4-in. pine, floor timbers
- 12 pcs. $\frac{1}{8}$ x $\frac{3}{4}$ x 38-in. pine, bottom planking
- 2 pcs. $\frac{1}{8}$ x 3 x 38-in. pine, side planking
- 1 pc. $\frac{1}{8}$ x $8\frac{1}{2}$ x 38-in. pine, deck planking
- 3 pcs. $9/16$ x 6 x 18-in. pine, lead mold
- 1 pc. $9/16$ x $9/16$ x 54-in. pine, mast
- 1 pc. $7/16$ x $7/16$ x 20-in. pine, boom
- 1 pc. $\frac{3}{8}$ x $\frac{3}{8}$ x 13-in. pine, jib club
- 1 pc. 2 x 3 x 15-in. pine or spruce, stand
- 1 pc. $\frac{1}{4}$ O. D. x 5-in. brass, rudder tube
- 1 pc. $3/16$ O. D. x 5-in. brass, rudder post
- 1 pc. $\frac{1}{4}$ x $2\frac{1}{2}$ x 3-in. pine, rudder blade
- 1 pc. $3/16$ x $10\frac{1}{2}$ -in. brass rod, keel bolts
- 4 No. 10-24 brass nuts for keel bolts
- 2 brass washers for keel bolts
- 8 lbs. lead for two-part keel
- 3 gross $\frac{1}{2}$ -in. brass escutcheon nails
- 1 lb. waterproof resin glue
- 12 brass screw eyes
- 7 ft. $1/32$ -in. brass wire for shrouds
- 1 pc. No. 28-ga. x 1 x 8-in. sheet brass for mast step, jib rack and chain plates
- 1 pc. No. 22-ga. x 12-in. brass wire for hooks
- 1 pc. $1/16$ x $3/16$ x 6-in. brass for tiller
- 1 No. 6-32 x $2\frac{1}{2}$ -in. brass bolt, 2 nuts, 2 washers
- 1 pc. $1/16$ x $\frac{3}{4}$ x 5-in. sheet brass for traveler angles and spinners
- 1 pc. $7/16$ O. D. x $\frac{1}{2}$ -in. brass tube, mast ferrule
- 20 ft. light fish line (braided preferred)
- 18 No. 2 x $\frac{1}{2}$ -in. brass screws to fasten chines
- 10 ft. $\frac{1}{4}$ -in. linen tape
- $1\frac{1}{2}$ yds. oiled silk for sail





corners and finishing with sandpaper.

About $1\frac{1}{2}$ yds. of cambric or oiled silk are needed for the sails. Spread the material out flat and mark it as shown in Fig. 18. Keep the main-sail leach A-C, about 2 in. in from the selvage edge. At B-C allow $\frac{3}{4}$ in. for attaching the headboard. Draw a straight line from A-C and measure out $1\frac{1}{2}$ in. for the curved edge. Do the same at the foot. Along the luff B-D, make marks 16 and 32 in. from D. At the 16-in. mark, you measure out $\frac{1}{8}$ in., while at the 32-in. point, you measure in $\frac{1}{8}$ in. Through these points a reversed curve is drawn to give the right set to the sail. A $\frac{3}{4}$ -in. margin is allowed along B-D for hemming, while $\frac{3}{8}$ in. is sufficient along A-C and A-D. The jib sail is laid out similarly. The luff is curved through a point marked $\frac{5}{16}$ in. in, 12 in. from G, while on the leach the curve is brought out $\frac{1}{2}$ in., 14 in. from the same point. Before cutting the sails on the margin lines, sew $\frac{1}{4}$ -in. tape inside lines B-D and E-G and straight across from A-D and E-F to keep the bias edge from stretching. Fold and sew a wide hem over the tape on the luff of each sail and a narrow one on the leach and foot. Along the luff of the main-sail, shoe eyelets, or grommets, are spaced 3 in. apart through which a light cord is threaded and wound spirally around the mast as in Fig. 16. The clew and tack of the jib are tied loosely to the club in a manner similar to the mainsail, Fig. 22, while the cord in the luff, Fig. 17, runs to a hook in the deck jib rack. Figs. 20 and 21 show clearly how the main and jib sheets are rigged. The two wire shrouds



which hook to the chain plates are looped around the mast at the top of the jib screw eye and adjusted to give the mast a $1\frac{1}{2}$ -in. rake aft.

The hull, keel, rudder and deck border of "Starlet" were enameled green, while the deck, mast, boom and club were finished natural with white shellac. Before applying the first coat which should be thinned slightly with turpentine, give the wood a thorough sanding with Nos. 0 and 00 sandpaper. Between each coat rub down the enamel with No. 6-0 sandpaper or fine steel wool. The third and final coats may be left glossy, or rubbed down and waxed.

Tool Rack on Top of Stepladder Saves Many Steps



Much of the time consumed in getting off a stepladder after tools can be saved if you convert the top of the ladder into a tool rack. Holes can be drilled near the rear side to receive tools such as chisels, screwdrivers, etc., while the ends can be notched for saws, hammers, wrenches, etc. Strips of hardwood or flat iron are screwed over the open ends of the notches.

Seamed Tubing Is Spread Evenly With Wooden "Egg"



If you have to spread a piece of seamed tubing, you can do the work uniformly by using a piece of hardwood turned to the shape of an egg, making a flat surface on one end for driving. The diameter of the egg will depend on the work at hand. After the egg has been driven in flush with the

end of the tube, a wood rod slightly smaller than the inside diameter of tube is used to drive it the rest of the way.

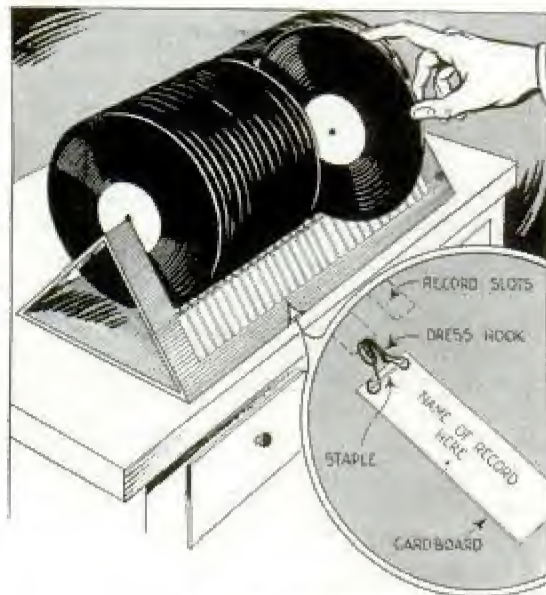
Light Shop Machinery Levelled With Aid of Bent Washer

Having a number of small woodworking machines to set on an uneven floor, one mechanic solved the problem of leveling them by using bent washers under the feet of each machine. Tightening of the lag screws that anchored the machines caused the washers to spread and reduce the space between the feet and the floor the required amount. The weight of the machines was not sufficient to spread the washers once the machines were leveled.



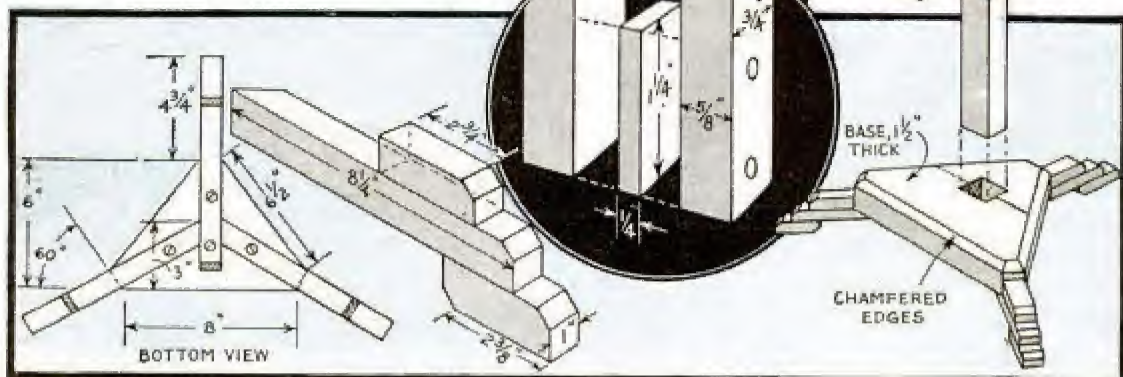
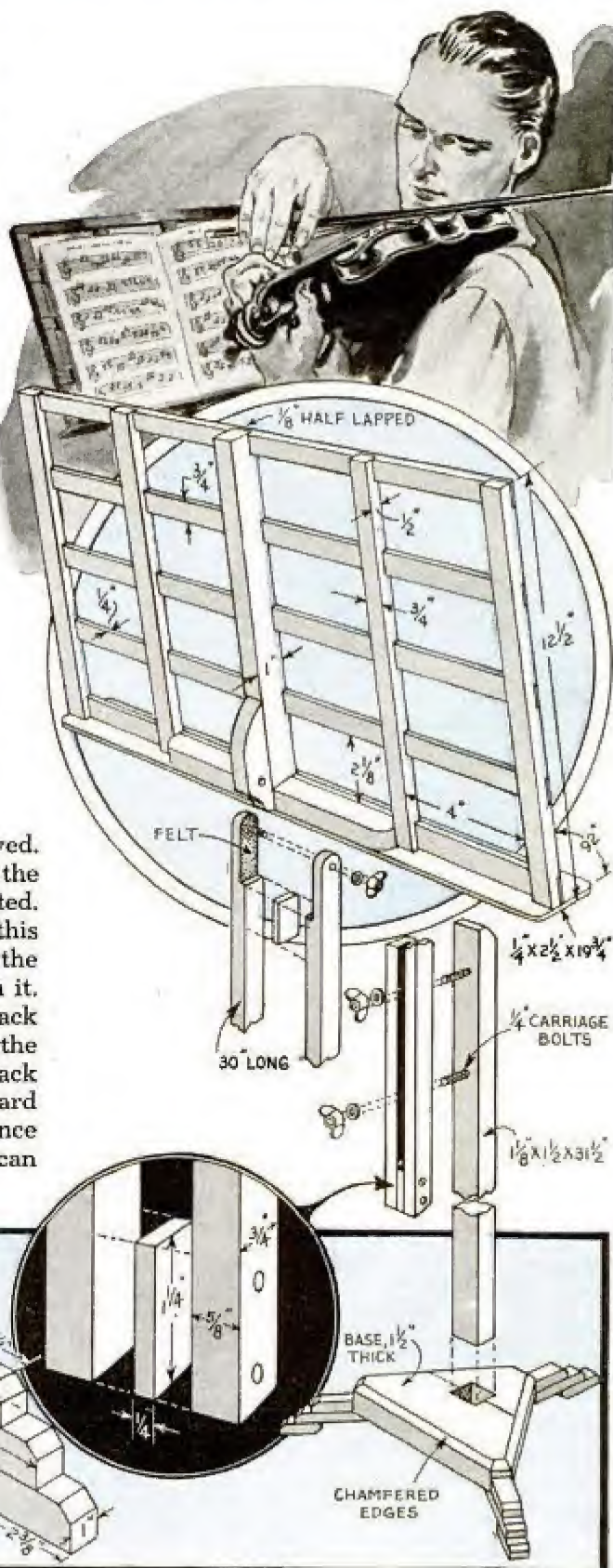
Tags on Phonograph-Record Rack Show Position of Records

Here's a simple way to identify your records so they can be selected quickly from a phonograph-record holder of the type shown. Make a tag for each slot from a strip of cardboard and attach an ordinary dress hook to each one with a paper staple. The names of the records are next printed on the tags, which are then hooked in their respective slots.



Adjustable Music Stand Is Inexpensive to Make

For use in schools or at home where stability and rigidity are more important than portability, this music stand is highly satisfactory. It can be made of any wood at hand. Begin with the base, which is triangular in shape, and has three feet screwed to it. Each foot consists of three pieces assembled with glue as shown in the lower left-hand detail. The base is mortised for the standard, which is in two parts, the upper part being made of two strips with spacer blocks at each end. This construction provides a long slot for adjustment by means of two bolts and wing nuts located in the lower part of the standard, which is a length of solid stock. The upper part of the standard is pivoted to the music rack with a long bolt, which passes through a block screwed to the rack as indicated in the circular detail. Five $\frac{1}{4}$ by $\frac{3}{4}$ -in. horizontal strips and four $\frac{1}{2}$ by $\frac{3}{4}$ -in. and one $\frac{3}{4}$ by 1-in. vertical strips make up the rack. These are half-lapped at the joints, which are glued and screwed. The heavier vertical strip is used in the center where the standard is pivoted. Two blocks, one on each side of this strip at the lower side, reinforce the rack at this point and tend to stiffen it. A strip across the bottom of the rack provides a ledge on which to rest the music. Planing the lower edge of the rack to give the ledge piece a slight downward tilt of about 2 degrees provides clearance for the pages of music so that they can be turned easily without binding.



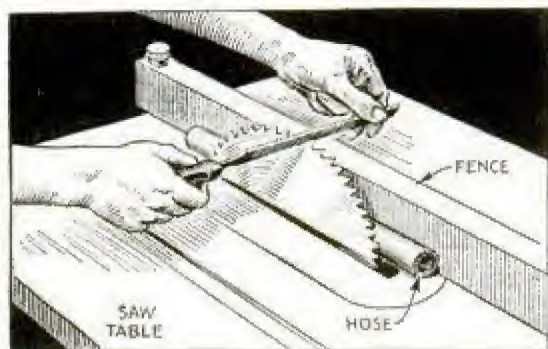
Funnel Dasher Mixes Solution Used to Spray Trees



To speed up the dissolving and mixing of chemicals for his orchard spraying machine, one farmer wired a large funnel to the stirring stick. By churning this up and down in the mixing barrel, the liquid was agitated violently, and the solids were carried up through the spout instead of merely rotating around the bottom of the container, and were dissolved quickly.

Rubber-Hose Wedge Holds Saw While Filing It on Mandrel

The next time you want to touch up the teeth of your circular saw with a file, just wedge a piece of rubber hose between the saw and the ripping fence. This will pre-

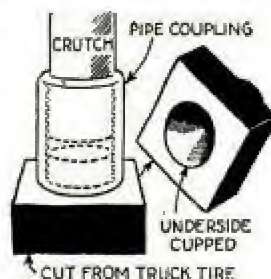


vent the saw from turning, and will also silence any tendency to screech caused by drawing the file across the teeth.

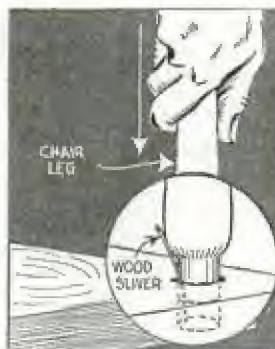
Crutch Tips From Truck Tire

I make long-wearing crutch tips from the thick, tough rubber of old truck tires. The tips are cut to shape and then forced into pipe couplings screwed onto the ends of the crutches. For use on sidewalks and hard ground, tips shaped like the one shown are ideal. If you do much walking on soft ground where the tips are likely to sink into it, the tips can be made larger to prevent this.

—V. A. Doty, Attleboro, Mass.



Wood Sliver Vents Glued Dowel For Easy Driving



When a dowel isn't grooved to vent it while driving, you can accomplish the same thing by using a thin sliver of wood. Just insert the sliver at the edge of the hole as shown, and drive in the dowel. After

this has been done, the sliver can be cut off flush with the surface after the joint has been completed.

Finger Ring Keeps Twine Handy When Wrapping Packages

Slip the twine through your finger ring as indicated the next time you have a number of packages to wrap. In this position, the end will always be at hand when a package is ready.

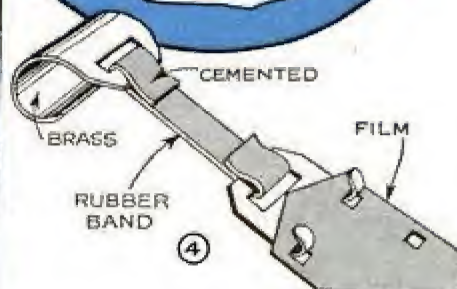
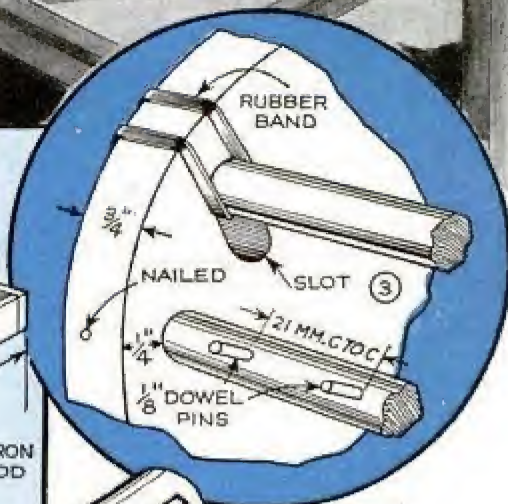
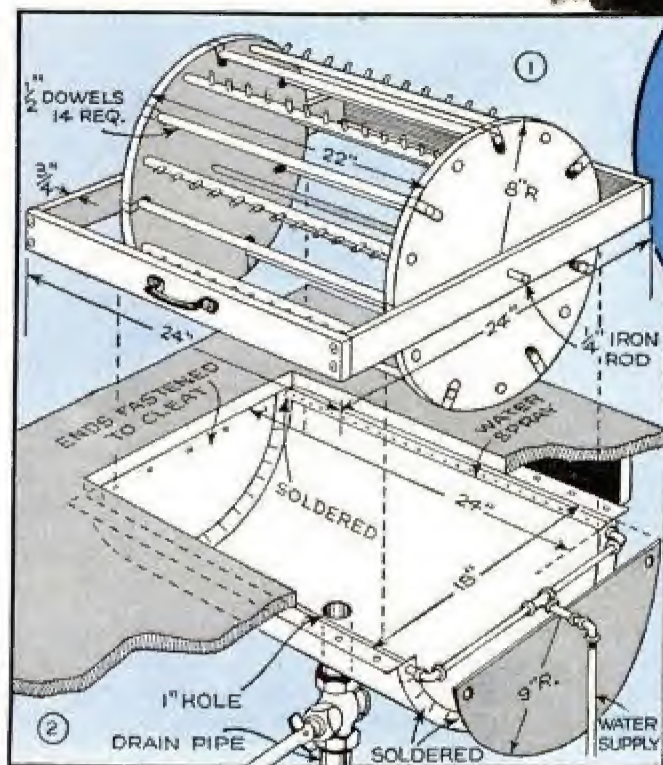
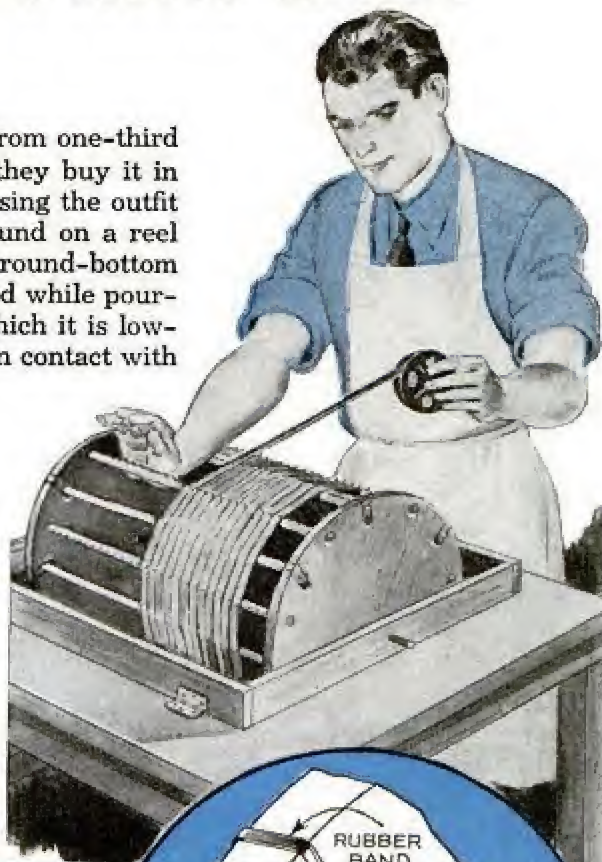


PROCESSING EQUIPMENT *for Home Movie Film*

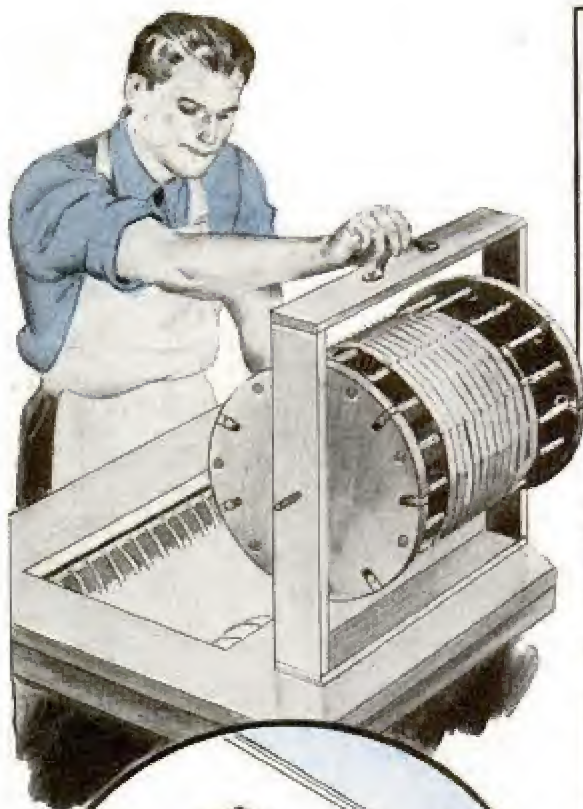
By J. R. Bailey

AMATEUR movie-makers can save from one-third to one-half on the cost of film if they buy it in bulk and do their own processing. In using the outfit described here, the exposed film is wound on a reel mounted in a hinged frame above a round-bottom sheet-metal tank. The reel can be raised while pouring the solutions into the tank, after which it is lowered and revolved to bring all the film in contact with the solutions. Water for washing the film between and after the baths in the solutions, comes from two copper tubes, one at each side of the tank. Holes are drilled along their length.

The entire processing outfit takes little floor space. The table has a 34 by 36-in. top, which is cut out to take the tank. A convenient height for the table is 36 in., but this can be altered to suit the individual. The tank, Fig. 2, is made of three pieces of galvanized sheet metal, soldered together. The drain is fitted with a valve and can be swung around over a wide-mouth



A clip like the one above is used on each end of the film to hold it on the reel. Each clip consists of two pieces of brass joined together by a strong rubber strip

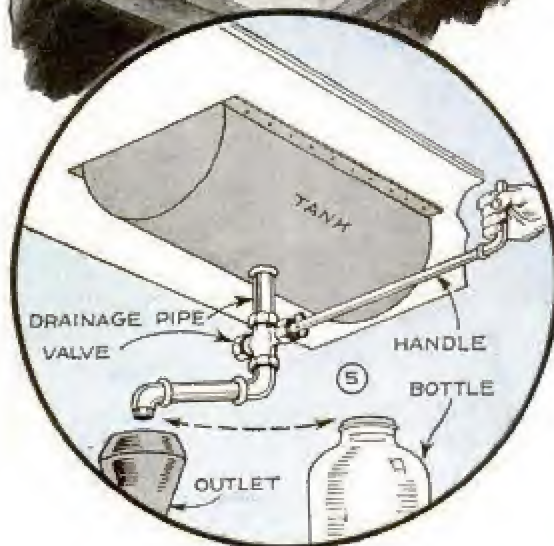


STEPS IN PROCESSING

1. Washing and stretching . . . 5 min.
2. Developing . . . 4 min.
3. Hardening . . . 3 min.
4. Washing . . . 3 min.
5. Bleaching . . . until silver is removed
6. Washing . . . 3 min.
7. Clearing . . . 4 min.
8. Washing . . . 3 min.
9. Exposing . . . 2 min.
10. Redeholding . . . 4 min.
11. Washing . . . 5 min.
12. Drying

The film guide pegs are $\frac{1}{8}$ -in. dowel pins spaced to accommodate 16-mm. film. The pegs are mounted only in the seven stationary dowels and as the film is wound in a spiral, it is necessary to make allowance for this in the location of the pins

on each dowel. The clip by which each end of the film is fastened to the reel is detailed in Fig. 4. The frame holding the reel is $\frac{3}{4}$ -in. wood and is hinged to the table. A drawer pull on the front is convenient for moving it up and down.



bottle to recover solutions that may be used again.

The reel, Fig. 1, is made by mounting two 16-in. wood disks on an iron-rod axle. Fourteen $\frac{1}{2}$ -in. dowels, spaced equidistantly, are mounted between the disks about $\frac{1}{4}$ in. from their edges, but only seven of the dowels are mounted solidly. The other seven are set in slots and the ends are forced toward the outer extremities of the slots by heavy rubber bands. By tying down the ends of the movable dowels before winding the film on the reel and cutting the strings after it is in place, the film will be kept taut while it is being processed.

FORMULAS

Developing solution

Water	1 gal.
Elon	180 grains
Hydroquinone	$1\frac{3}{4}$ oz.
Sod. sulphite	7 oz.
Pot. bromide	$\frac{1}{2}$ oz.

Use equal amounts of solution and water. For redeveloping, add $\frac{1}{2}$ dram 26-deg. ammonia water per 16 oz. of diluted developer.

Hardener

Pot. chrome alum	$\frac{1}{2}$ oz.
Water	16 oz.

Bleaching solution

Water	58 oz.
Pot. bichromate	$3\frac{1}{2}$ oz.
Sulphuric acid, conc.	$6\frac{1}{2}$ oz.

Use 1 part solution to 15 parts water.

Clearing solution

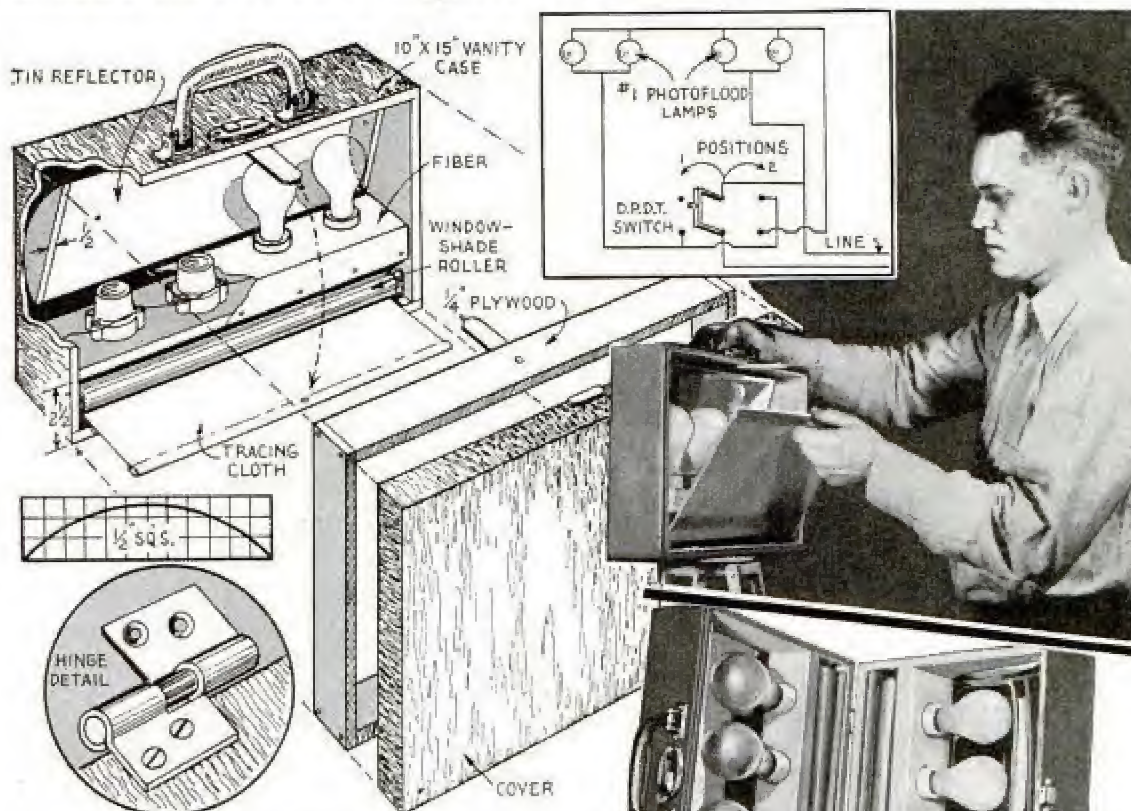
Water	48 oz.
Sod. sulphite	12 oz.
Add water to make	60 oz.

Use 1 part solution to $6\frac{1}{2}$ parts water.

The twelve steps of processing and formulas for the solutions are shown in the boxes on this page. The film may stretch slightly after the first wetting and have to be tightened. As the tank is semicircular, very little solution is needed to contact the film as the reel is revolved. After step 2, the developer is recovered and may be used for redeveloping, step 10, by adding $\frac{1}{2}$ dram of 26-deg. ammonia water to each 16 oz. of developer. Where washing is indicated, the drain is set over the waste funnel, the water turned on and the reel revolved in the spray. The final washing should be especially thorough.

¶If a wire is run from the metal part of your photo enlarger to a good ground, such as a cold-water pipe, static electricity will be eliminated and dust can be brushed from the enlarger easily.

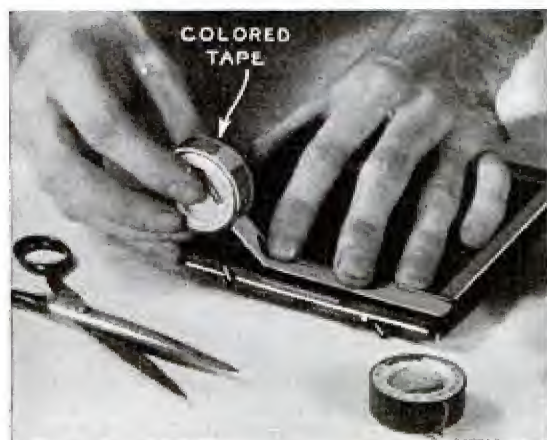
Bank of Photo Lights Housed in a Vanity Case



Ideal for both movie and still photography, this bank of eight photo lights can be taken apart and set up as separate 4-light units on any flat surface or camera tripod. The lights are mounted in a cheap vanity case which has an extension built onto the lid so that both parts are of equal depth. Hinges may be made from a large butt hinge by sawing it through the center and soldering a pin in two of the pieces so that the units may be separated easily. A shelf nailed in each half of the case provides a

base to which the electrical sockets are screwed. Reflectors are held in shape by curved end pieces, while strips of tracing cloth on window-shade rollers are used for diffusing the light. If desired, a dimmer switch may be installed as indicated.

Colored Tape on Holders Identifies the Film They Contain



Film holders containing several different kinds of film will be easy to recognize when they become mixed in your camera case if you mark each holder with a small strip of colored cellulose tape. You can use green tape to indicate "pan" film and red for "ortho," using strips of various lengths to mark different kinds of each type.

—William Swallow, Brooklyn, N. Y.

❗In compounding formulas always mix chemicals in the order given in the instructions and be sure that each chemical is dissolved before the next one is added.

Plastic Cup Has Notch in Rim To Pour a Fine Stream



Accuracy in weighing small quantities of chemicals in the photographic darkroom can be increased by using a small plastic measuring cup with a notch filed in the rim. Dry chemicals can be poured through

the notch in a fine stream and exact balance is obtained quickly.

—Kenneth Murray, Colon, Mich.

Smoke Locates Holes in Bellows

Minute holes in camera bellows can be located as follows: With the bellows extended, remove the lens from the camera and blow some smoke in the hole from which it was removed. Place your thumb over the lens opening and push the bellows together slowly. If there are any pinholes, a fine stream of smoke will emerge from each one.



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Whether it's a simple rowboat, an outboard runabout or a family cruiser, you'll find something you want among our plans. Build your boat now for the coming season



"Banta," 12-Ft. Runabout—1080-1081

"Banta," 12-Ft. Plywood Runabout—1080 and 1081: Simplified construction makes this plywood runabout easy to build. Here's the boat to take along on that weekend trip. 2 prints 50c.

"Falcon"—1070-1079 Incl.: Trim, sturdy 18-ft. inboard runabout or cabin cruiser. 66 in. beam, 42 in. total depth, 7 or 8 passengers. Makes a speed of about 17 m.p.h. with a 20 h.p. motor. 10 prints, material list and procedure \$2.50.

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12-Ft. Rowboat—707: Flat bottom. Can be used with small outboard motor. 25c.

"Sea Saucer"—893: Lightweight sailboat. Length 9½ ft. Planked with 3/16-in. plywood. 25c.

16-Ft. Canoe—811 and 812: Cedar planking covered with canvas. Two prints 50c.

Canvas-Covered Kayak—928 and 929: Light framework covered with canvas. 17 ft. in length and accommodates single passenger. Two prints 50c.

7½-Ft. Plywood Rowboat—1068: Made from waterproof plywood this boat is easily transported on top of car. Complete instructions and material list included. 25c.



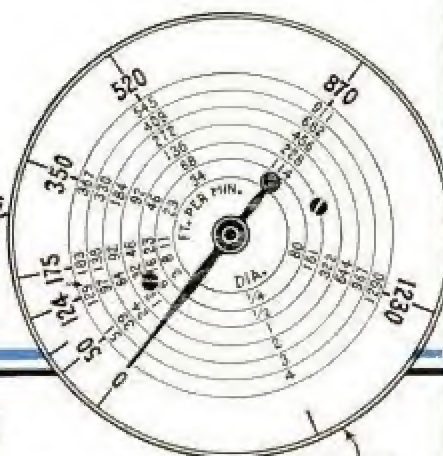
SHOP NOTES

LATHE DIAL *shows cutting speed*

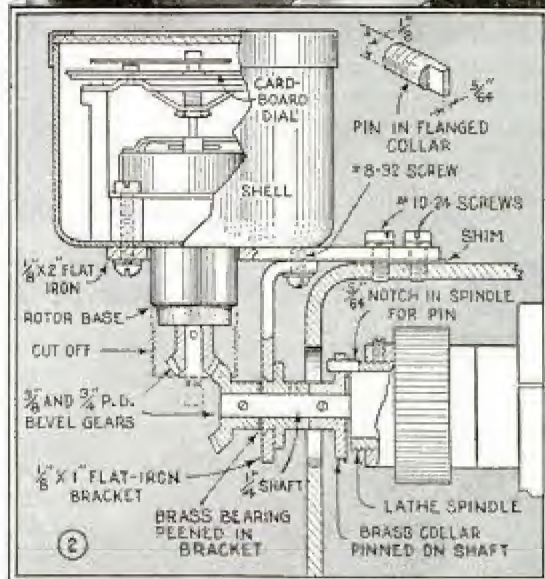
By F. N. Schwend

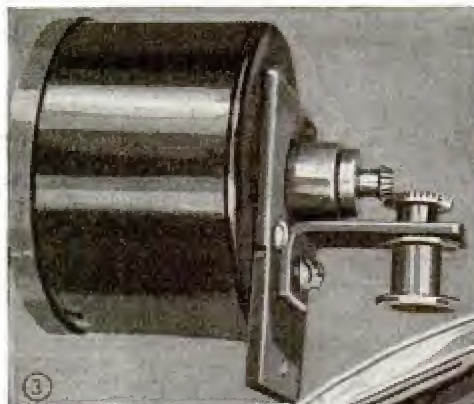
TO OBTAIN the maximum efficiency of a lathe, the work should be rotated at a speed commensurate with the type of metal being turned, the kind of cut, whether lubricant is used, etc. Too high a speed will cause the cutting tool to burn, and will tend to produce chattering and overheating, while too slow a speed not only wastes time, but may result in a rough cut. However, these points are often ignored, principally because of the inconveniences in calculating the speed, which varies with the diameter of the work as well as the r.p.m. of the lathe spindle.

However, it is an easy matter to determine lathe cutting speeds on an indicator, which can be made from an automobile speedometer as shown in Figs. 2, 3 and 5. The speedometer is taken apart, the square shank of the rotor shaft is cut off and the threaded portion of the die-cast base is cut back to allow one of a pair of bevel gears to be pinned to the round part of the shaft. A bracket of heavy flat iron supports the indicator on the end cover of the lathe, the size and shape of the bracket depending on the construction of the lathe. A bearing is put in one leg of the bracket, and a drive shaft carrying the second bevel gear, is fitted into the bearing. A flanged sleeve is formed to be fixed to the other end of the drive shaft and a pin is driven into a hole



① CARDBOARD





Correct Cutting Speeds	Heavy Cut	Finish Cut	Cutting Threads
Aluminum - - - -	200	300	50
Brass - - - -	150	200	50
Bronze - - - -	90	100	25
Cast iron - - - -	60	80	25
Steel, machine - -	90	125	35
Annealed tool steel -	50	75	20

Determining cutting speeds
 $\frac{\text{Diameter in in.} \times 3.1416 \times \text{R. P. M.}}{12} = \text{Ft. per min.}$

Fig. 1. A series of concentric circles are drawn on the dial, one for each of a series of diameters, which are marked between the circles. For example, the diameters may be set off to range from $\frac{1}{4}$ to 4 in. although this may be determined by the size of the lathe, etc. The r.p.m. at each speed are marked in the outside circle in line with the corresponding needle positions. The cutting speeds in ft. per min. are then calculated for each combination of lathe speed in r.p.m. and diameter.

When it is desired to check the cutting speed of a piece of work, follow the circle indicative of the

nearest diameter, around to the number under the needle position, which number will indicate the actual cutting speed.

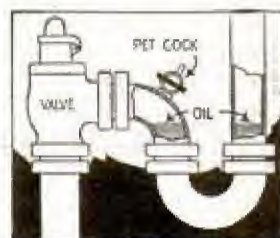
The correct cutting speeds may be found in a number of published tables. The general speeds in Fig. 4 may be used if such tables are not available. Also, the indicator may be used for selecting the correct speed of the lathe for a given diameter of the work and cutting speed in ft. per min. by following the corresponding diameter circle around until the nearest cutting speed value is found. The aligned r.p.m. value in the outside circle will then indicate the correct spindle speed.

in the flange so that it extends outwardly to engage a notch filed in the end of the lathe spindle.

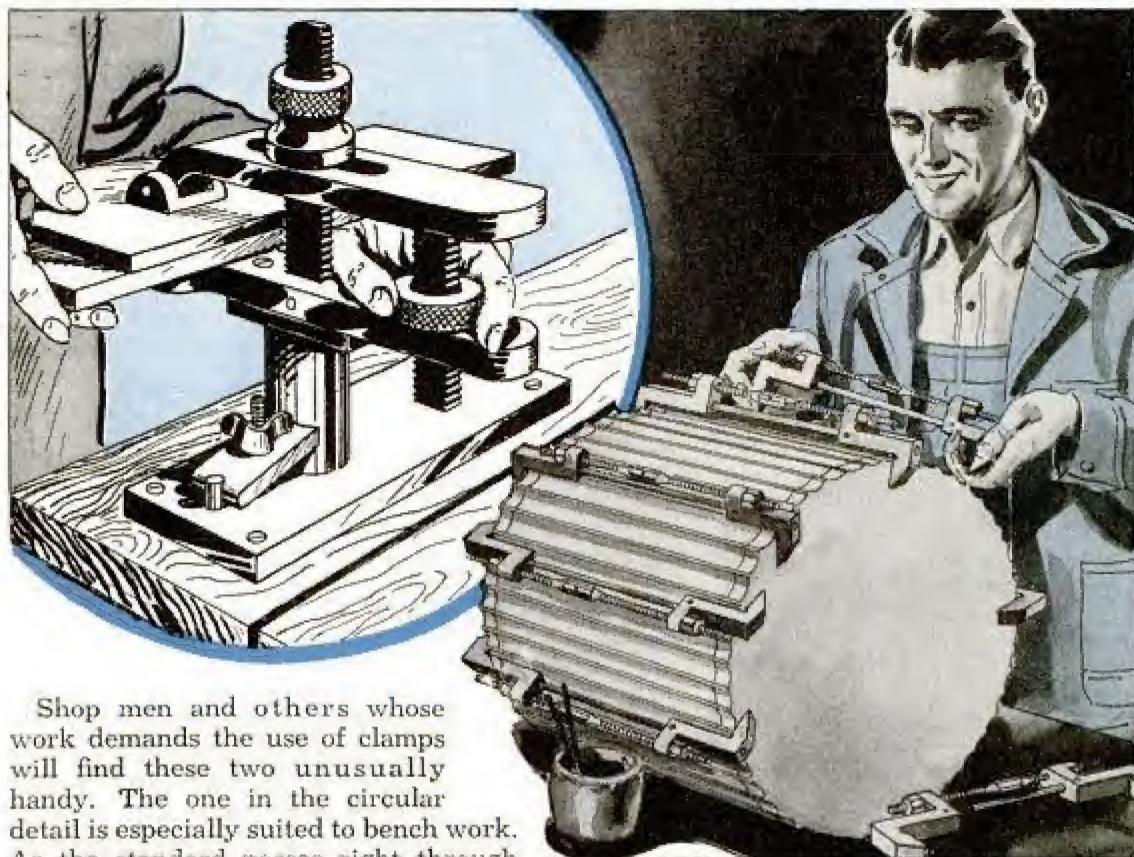
This arrangement permits the indicator to be swung out of the way when a collet chuck is used or when the work is to extend through the lathe spindle. Closing the end cover and rotating the spindle to align the pin with the notch couples the indicator. The ratios of the bevel gears may vary from 1 to 1 to 2 to 1, the latter giving a full scale deflection of the needle at approximately 1,250 r.p.m. on most speedometers. The range may be varied considerably though, by adjusting the hair spring, while with a 1 to 1 ratio considerably higher speeds may be indicated. The r.p.m. of the lathe at each of its different speeds is determined either by calculating the different pulley diameters and motor speed, or by using a revolution counter. The needle positions at the different lathe speeds are marked on the regular dial. These marks are then transferred to a new dial of heavy white paper which is later secured to the face of the old dial,

Oil Trap Helps Locate Slight Leaks in Gas-Line Valves

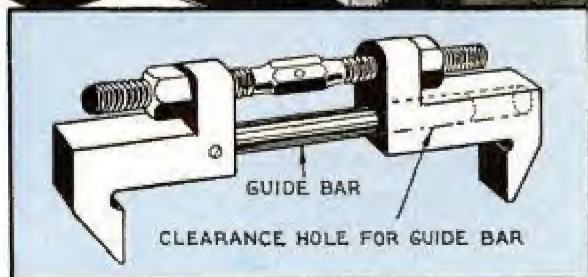
To locate a slow, imperceptible leak in a safety or stop valve of gas or air lines, one engineer uses a U-shaped pipe assembly attached to the valve as indicated. Oil in the U-pipe traps escaped gas, which then builds up a slight pressure. Opening a pet cock on the pressure side of the U-pipe after a while, enables him to detect the presence of escaped gas either by odor or sound. An oil that will not absorb the particular gas, or be absorbed by it, must be used.



These Two Clamps Handle Wide Variety of Work



Shop men and others whose work demands the use of clamps will find these two unusually handy. The one in the circular detail is especially suited to bench work. As the standard passes right through the bench top, it can be adjusted in height or swung around by loosening the wing nut on the clamping wedge at the base. The wide upper jaw gives uniform pressure over a large area, and the slot in the jaw permits moving it back and forth. In cases where a heavy-duty clamp of the bar type is needed, the one in the lower detail is just the thing.



Small Coal Bins at Scales Help Get Exact Load Weights



Built close to his scales, small bins make it convenient for a coal dealer to bring a load of coal to the desired weight. If a load is slightly heavy, a little coal is shoveled into one of the bins, there being a bin for each kind of coal. When a load is light, the amount needed can be taken from one of the bins. Also, they serve as a display for customers who wish to see the coal before buying.

❑ If your electric-light pull chains are broken by being jerked too hard, put a small coil spring about the size of a light screen door spring in each chain.

Pipe Stakes Pulled From Ground By Hand With a Pick



You can get good leverage for pulling pipe stakes used to anchor various farm machines solidly to the ground if a pick is used as shown. Three or four holes drilled in each stake to take the pointed end of the pick will enable you to progress from one hole to the other as the stake is raised.

Small Blocks Held on Faceplate With Center Screw and Tape



Instead of gluing a small block of wood to waste stock for attaching it to the lathe faceplate, use double strips of friction tape and place them, adhesive side out, under the block before tightening the center attaching

screw. The tape provides just enough friction to hold small blocks while turning.

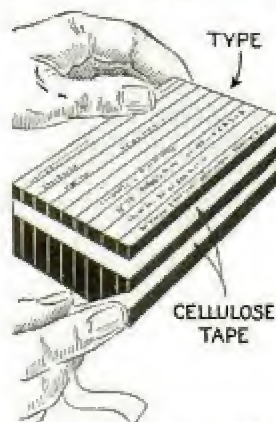
Flameproofing Cotton Fabric

An inexpensive method of fireproofing cotton fabric such as canvas, is to use a solution consisting of ammonium chloride, $\frac{1}{2}$ lb., dissolved in water, 1 qt. The cloth

is soaked thoroughly in the solution, then squeezed and allowed to dry. This method was helpful on canvas used to connect heating ducts.

Tape Holds Type Form Together

Before locking up a type form on a printing press, put a piece of cellulose tape around all four sides of the form. Then the type can be stored after the printing has been done without disturbing or piling the type which sometimes happens when string is used. The tape can be left in place when locking up the form.



Jewelers' Dustproof Parts Trays From Hollow Rubber Balls

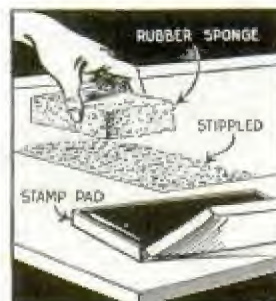


Handy dustproof trays for watch parts and other small pieces of jewelry can be made in a few minutes from hollow rubber balls. The balls are cut almost in half and fastened to the

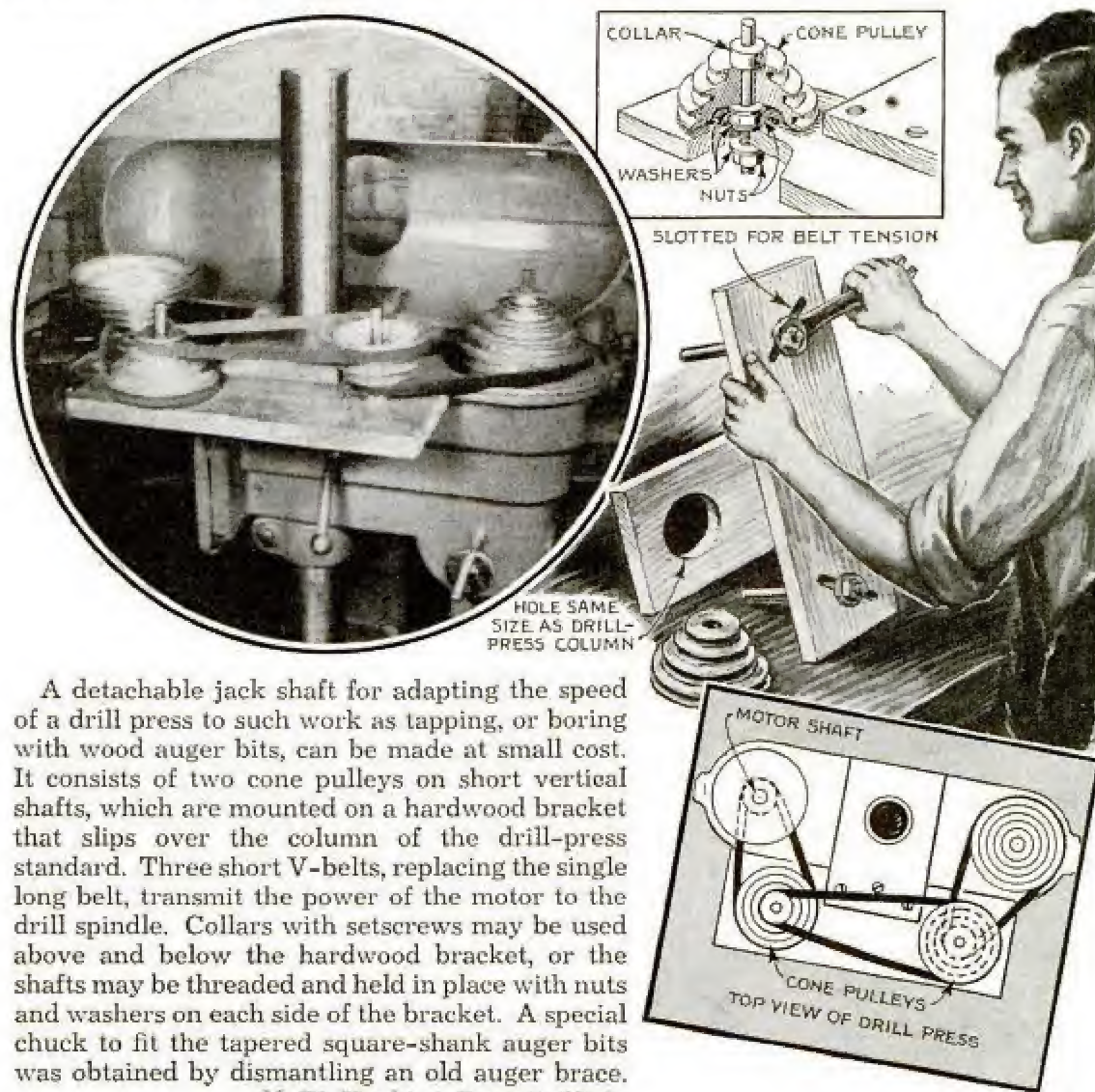
bench top or a block of wood with thumbtacks, as indicated in the drawing.

Easy Way to Stipple Show Cards

Show-card writers who do not have an air brush can tint or stipple card stock quickly with a rubber sponge inked on a rubber-stamp pad. With the coarse or fine-grain rubber sponges available, and ink pads of different colors, almost any desired stipple effect may be obtained.



Removable Speed-Reducing Unit for Drill Press



A detachable jack shaft for adapting the speed of a drill press to such work as tapping, or boring with wood auger bits, can be made at small cost. It consists of two cone pulleys on short vertical shafts, which are mounted on a hardwood bracket that slips over the column of the drill-press standard. Three short V-belts, replacing the single long belt, transmit the power of the motor to the drill spindle. Collars with setscrews may be used above and below the hardwood bracket, or the shafts may be threaded and held in place with nuts and washers on each side of the bracket. A special chuck to fit the tapered square-shank auger bits was obtained by dismantling an old auger brace.

—N. W. Hopkins, Detroit, Mich.

Bench Lamp on Improvised Wire Bracket Is Adjustable



If you want an adjustable bench lamp without the trouble of making a strong permanent one, this simple lamp will be suitable. It can be made quickly as it consists merely of a length of heavy wire or small iron rod bent as shown, and mounted on a wall above the bench with staples or screw eyes. The lower end of the wire is pointed and bent over to stick into the top of the bench. A loop at the upper end is bent against the lamp cord to hold it.

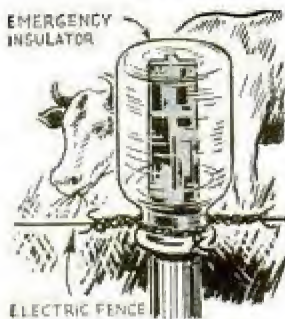
❏ Before planting strawberry plants prune the roots so they are about 4 in. long, and remove most of the leaves.

Gear Wheel Under Heavy Gate Prevents Sagging at End



Sagging of a heavy lot or field gate can be avoided easily by half-burying a discarded gear wheel from an old binder under the latch end as shown. One cog is broken out of the wheel to provide a solid resting place for the gate.

Bottle Is Emergency Insulator For Electric Fence



may be added by using such insulators when regular equipment is not available.

If an insulator of an electric fence is broken and one to replace it is not available, just slip an empty bottle over the stake top and attach the wire to this as indicated. Extra lengths of fence

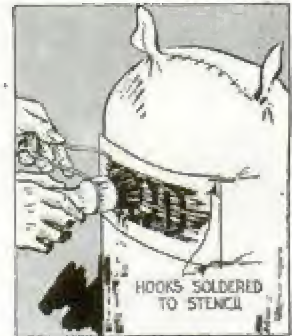
Cork Insulation Cut Easily

The general difficulty which mechanics have had in cutting cork insulation is in the use of the common crosscut saw. A

better way is to use a crosscut saw with extra large teeth. With it cork can be cut accurately and smoothly.

Handle and Hooks on Stencil To Letter Grain Sacks

In order to hold a stencil firmly against a filled grain sack with one hand, the operator of a grain and feed store soldered a couple of hooks at the corners of one end and a stiff, wire handle at the other.



In use, the hooks penetrate the sack cloth, holding the end firmly in place, while the other end is kept snugly against the sack by means of the handle.

Rubber Finger Stalls Speed Work Of Candling Eggs



To speed the work of candling eggs, and also to decrease the loss caused by breakage, one produce merchant provides rubber finger stalls for his workmen. These allow the eggs to

be lifted from the cases with little fumbling, automatically speeding up the output.

Loss of Small Parts Avoided By Tacky Surface on Board

In a shop where small motors, light fixtures, etc., were taken apart for repairing, loss of screws and other small parts was prevented by placing them on a board coated with belt dressing. The parts adhere to the tacky surface to prevent accidental displacement.

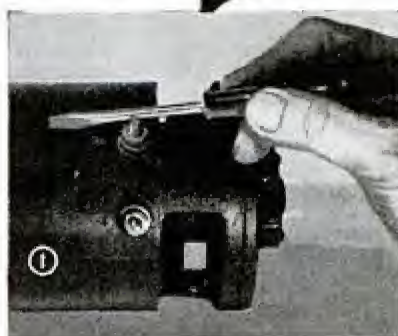


Servicing Car GENERATORS

By C. E. Packer

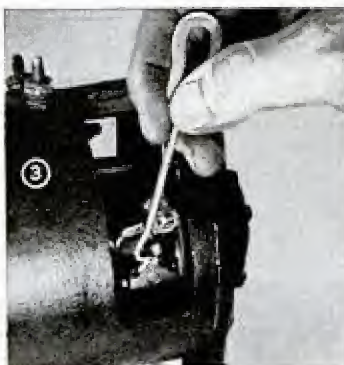
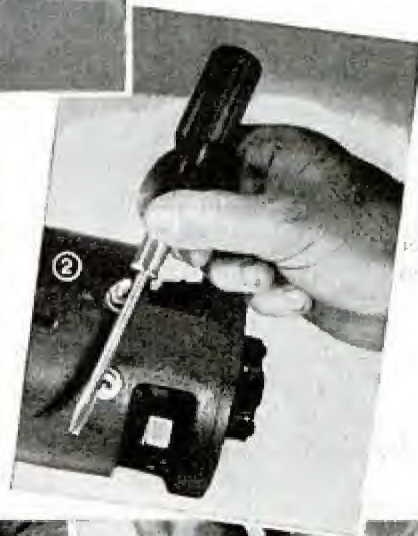
IT'S USUALLY some little thing that makes a generator stop working. Failure generally begins when the ammeter needle flickers to zero and back.

First, you want to know whether the trouble is in the generator itself or in the regulator, which controls the output. Before attempting this check, it is necessary to know if the circuit between the generator and the battery is complete, which may be determined by closing the cut-out points and noting the ammeter reading. With the engine at rest, the discharge indication will be between 15 and 20 amperes. Two simple tests are made. With the motor running at an approximate 20 m.p.h. road speed, and without having disconnected any wires, hold a screwdriver across the field terminal and the generator frame as in Fig. 1, being sure to make good electrical contact. This completes the field circuit in those generators in which the field is connected internally to a "hot" brush and has but to be grounded to give maximum output. If the ammeter shows charge when this is done the trouble is outside of the generator. If no charge is indicated the generator may be at fault, which is further checked by a second test on generators having separate field and armature terminals; these being connected together as in Fig. 2. This test completes the field circuit in generators that have a field grounded within the generator but which must be connected to the main brush to receive current. Continued

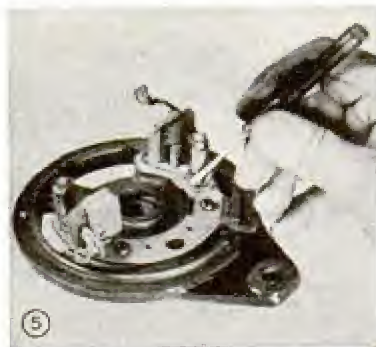


If the ammeter needle flickers from charge to zero, trouble is brewing. Perhaps the commutator must be turned down and the insulation between the bars must be undercut

To check generator, after making sure that circuit to battery is complete, start the motor. Then, without disconnecting any wires, first ground field terminal on some generators, Fig. 1; on others, hold screwdriver across terminals, Fig. 2. If ammeter does not show charge, generator is faulty



With a bent wire, you can lift out the brushes to see if they are stuck in the holders or whether they are worn down too far and should be replaced with new ones



When necessary to remove the generator, the end cap to which the brush holders are attached is slipped off and the insulation of the insulated brush holder is examined as in Fig. 5 to see if there is a short circuit. Slots between commutator bars are scraped and brushed clean, Fig. 6, as carbon dust may cause a short circuit across them



Sometimes damage to insulation on armature coils where they connect to the commutator, can be repaired satisfactorily by wrapping it with cord as shown in Fig. 8. After the wrapping is completed the cord is given a thorough soaking with shellac and allowed to dry



When new brushes are installed at the time a generator is dismantled, you can make the contact surfaces of the brushes conform to the curvature of the commutator by rubbing them on fine sandpaper wrapped around the commutator and held with cord as in Fig. 9



To wrap a wire having broken, double the cord, lay the doubled portion lengthwise on the wire, and while holding the end of the cord with one finger, start wrapping from this end toward the loop. When you get there, slip the loose end through the loop and pull the other end so the loop closes and grips the loose end tightly



failure to charge indicates a defective generator but if a charge is shown the trouble is elsewhere.

When it is known that the generator is defective, stop the motor and examine the brushes. Lift them up as in Fig. 3, with a wire or buttonhook bent to an L-shape at one end. Perhaps the brushes are stuck in the holders. Then lift the retaining springs and remove the brushes as in Fig. 4 to see if they are worn down too far. Usually brushes should be replaced after approximately 15,000 miles of car service. Should there still be no indication of charge after replacing the brushes, remove the generator from the car.

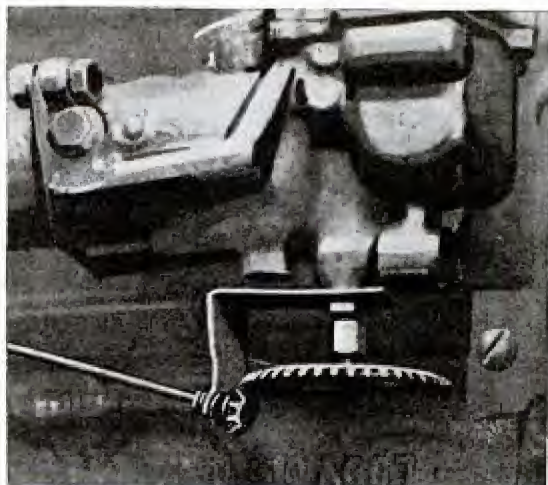
Now, with the brushes lifted from the commutator and held in place by side pressure of the brush springs, the wires to the brush holders are disconnected and the cap that carries the brush holders is removed from the generator. A frequent cause of failure is excessive oiling, which

soaks insulation and retains carbon dust that comes from the brushes, causing a short circuit. Examine the insulation of the insulated brush holder as in Fig. 5, to see if it has been charred. If in doubt whether this insulation is defective, make a test with a light. Short circuits between the copper bars of the commutator are common. Here again, oil holding carbon is often the prime cause. It is not enough to clean a commutator with a rag or fine sandpaper as this gives only temporary relief. You should scrape and brush all dirt out of the slits between the commutator bars as shown in Fig. 6. If the commutator is rough and looks as if it has been burned, and if the insulation between the bars comes flush with their surface or projects slightly, the commutator should be turned down in a lathe as lightly as possible, and the insulation between the bars should be undercut.

Next to brush and commutator troubles,

the most common causes of failure are short circuits, open circuits and grounded circuits. Often the trouble is due to wires rubbing on the armature. Bared wires should be re-insulated by wrapping them with cord but the wrapping should not be more than 2-in. long. Should more wrapping be necessary put it on in sections of 2 in. or less. Fig. 7 shows a wire wrapped and the accompanying caption tells how this is done. Shellac on the wrapping will stiffen the wire so that it will not sag down against the armature. Tape should not be used inside a generator as it may loosen and cause serious trouble. If you notice that the armature coils are in any way damaged where they connect to the commutator bars, you can re-wrap the wire with cord as shown in Fig. 8, after which it is thoroughly shellacked. If new brushes are installed when the armature is removed from the generator housing, the brushes are sanded down to the proper curvature on fine sandpaper wrapped around the commutator as shown in Fig. 9.

Tractor Carburetor Adjusted From Driver's Seat



With a ten-cent egg beater and a length of steel rod, engineers of the Iowa State Agricultural College rigged up this method of adjusting a tractor carburetor from the driver's seat. They have been able to save 4 to 5 gal. of fuel a day with the tractor on heavy terracing work merely by thinning the mixture whenever the tractor motor was idling or not pulling a load. When a richer mixture is needed to provide power for heavy pulling, a slight twist of the rod does the job.—S. H. Reck, Jr., Ames, Ia.

Armatures Held for Inspection In Holes in Bench Top



By drilling holes at different angles through the top of his bench, one mechanic claims he can handle small armatures for inspection and repair more easily than when a special cradle is used for the purpose. The armature shafts are inserted in the holes to hold the armatures at any desired angle.

Scoop Shovel Aids Truck Driver When Changing Heavy Tire

One truck driver finds that heavy tires can be changed easily if a scoop shovel is employed as a lever and skid when the wheel is jacked up. One hand is used to hold the tire erect while the other operates the shovel.



Wooden Hanger Makes a Handle To Carry Several Garments



Carrying up to a dozen finished garments on hangers is a simple matter for one cleaning shop owner, who uses a wooden hanger for a handle. Six evenly spaced notches are cut along the top edge on each side to keep the hangers in place.

Cobs Replace Expensive Brushes In Scouring Dairy Floor

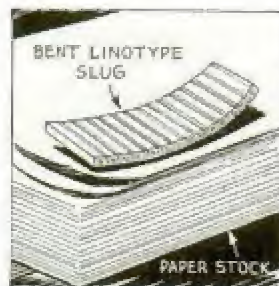
Finding that the concrete floors in his dairy buildings wore out expensive brushes rapidly, one dairyman saved money by substituting corn cobs for the



brushes. Use of the cobs enabled him to clean the floors efficiently, and they could be discarded when worn out. The cobs were sawed to fit in a mop handle.

Linotype Slugs Used as Weights In a Pressroom

Needing a number of small weights to keep stacks of paper stock from blowing around in the pressroom, one printer bent several linotype slugs as shown and used them for the purpose. Bending makes the slugs easy to pick up from flat surfaces.



Trick in Puttying Nail Holes



Instead of forcing putty into nail holes with a downward pressure of the putty knife, which leaves a thin layer of putty over the area, simply use your thumb to apply pressure on the putty and force it into nail

holes or cracks. The knife is then slid under the putty, removing the surplus and leaving a clean surface.

Rubber Protector Under Phone Avoids Scratches on Counter

In one office where calls for various persons came in over a single phone, this pad was provided to avoid scratching the surface of a counter on which the receiver was laid down. The pad is made from a sheet of corrugated rubber.

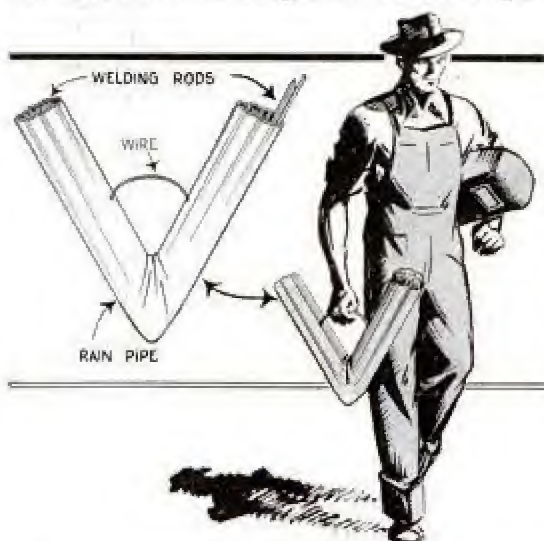


Causes of Smoking Boring Bits

A smoking boring bit is evidence that it is not of suitable design for the particular job, is not properly ground at the cutting edge, or needs sharpening. After the proper bit has been selected, its rotation in the boring machine must be proportionate to the rate of feed, that is, the faster the rate of feed, the faster must be the rotations of the bit. If this proportion is not correct, the bit will not remove the chips fast enough to clear itself and will heat and choke if forced to a faster rate of feed than its speed of rotation will allow. The travel of the bit must insure it from springing one way or another as it enters the wood. Poor grinding will cause the bit to lead one way or another as it enters the wood and cause heating. If the bit has not sufficient clearance at its ends, it will fit the hole too tight and heat. To remedy this condition, heat the end of bit and swage it enough to provide the necessary clearance. Following this operation, the bit should have its temper restored by proper heat treatment to make sure it will hold its cutting edge.

—Paul H. Graham, Plainfield, Conn.

Handy Carrier for Welding Rods Made From Length of Rain Pipe



Carrying a number of welding rods about on a job or from one job to another is a simple matter with this carrier. It is made by bending a length of rain pipe to the shape shown and welding or soldering a piece of wire to it by which it is carried.

—John Krill, Youngstown, Ohio.

Holes in Grain Sacks Are Closed With Rubber Disks



To close holes in full grain sacks, one seed-store owner forces rubber disks cut from an old inner tube through the openings, using the end of a broomstick. When inside the sack, the disks flatten out and are held over the openings by pressure from the grain.

Scratch Awl Lifts Waste Pieces From Jigsawed Cutouts

Removing waste pieces from jigsawed cutouts while on the saw table is a simple matter if you use a scratch awl for the purpose. This method is especially handy when several cutouts are made at one time as all you need to do is stick the awl into the pieces and lift them out.

—Pio Panieri, Roslyn, Wash.



Wanted!

MORE MACHINE-TOOL EXPERTS

Not just machine hands, but highly paid skilled technicians! That's the crying need in U. S. defense industries to meet exacting requirements of workmanship and ever-increasing production schedules.

Do you want to be an expert in this field? Then, start today getting the basic knowledge it takes, which, plus experience, advanced studies and keeping abreast with the latest developments, will soon qualify you as an expert.

To acquaint you with the most important and generally used machine tools, Popular Mechanics Magazine herewith begins a series of articles packed full of intensely practical information on these tools and how to use them efficiently.



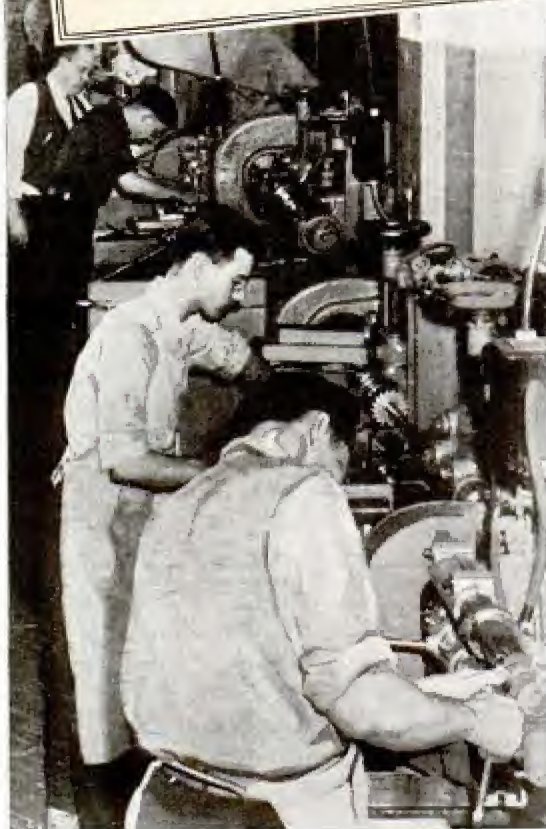
Above: This craftsman in the making is working at a boring mill, which often requires accuracy to .0001 in. Lower left: Men being trained to take charge of groups of operators in a large machine-gun plant

By H. J. Chamberland

BEFORE machine work is done on metal, the stock must be cut to rough size. While the hand hack saw is used in small shops on small work, in large shops the rough cutting is done with power hack saws, metal-cutting band saws, abrasive cut-off wheels and acetylene cutting torches. After rough cutting of stock, it goes through as many operations as necessary on other machines among which the drill press, lathe, shaper, milling machine and grinding machine are the most common and basic.

POWER HACK SAWS

Power hack saws, one of which is shown in Fig. 1, are used in thousands of machine shops for cutting off material up to 6 in. in thickness. These saws are either of the draw-cut or push-cut type. When draw-cutting, the blade is inserted in the saw frame so that the teeth point toward the rear of the machine, away from the operator, as in Fig. 3. With the push-cutting





PART
1

Power METAL-CUTTING SAWS *and how they work*

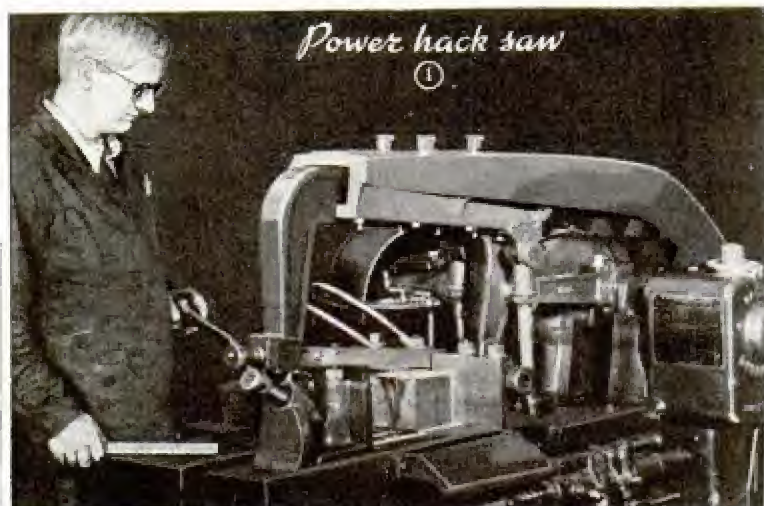
Cutting off pieces of bar stock, rods, pipe, etc., is the usual job for a power-driven hack saw, which is comparatively easy to run. Right: Here is a production line of metal-cutting band saws which are now being used to eliminate many older, slower and more complicated methods in machine-shop work



mechanism, the teeth point toward the front as shown in Fig. 4. Operation of a power hack saw is comparatively easy as you don't have to worry about guiding the saw, guess at the pressure, or lift the blade on return strokes as the machine does this automatically. The saw frame is locked in the raised position while adjusting the stock for the cut. Then the frame is gently lowered to the work. On return strokes the saw is raised by cam action so that the teeth clear the work.

Blades: Power hack-saw blades are much heavier than hand hack-saw blades, thickness of the former generally used being .049 and .065 in. Small and medium size machines take blades from 10 to 16 in. long, while blades up to 24 in. in length are used on extra heavy machines. Depending on length, the blades vary in width from 1 to 1½ in. Teeth per inch on blades most commonly used are 4, 6, 10, 14 and 18. There are blades made of molybdenum or high-

speed steel throughout, still many users prefer a welded blade such as shown in Fig. 5. A recently introduced double-edge blade is shown in Fig. 6. This one gives an extra cutting edge at 50 percent added cost. Cutting edge B has a narrower set than edge A so that by using edge A first, the set on edge B will not interfere while sawing and is used after edge A is dulled, which then gives no interference in the cut. Selection of the right blade to suit the work is of utmost importance. General rules are as follows: (1) the thinner the stock the finer the teeth should be; (2) the harder



② WHAT SAW BLADE TO SELECT FOR COMMONLY-USED MATERIALS

4 teeth per inch
Large, solid stock including large-diameter hard alloys and tool steel.

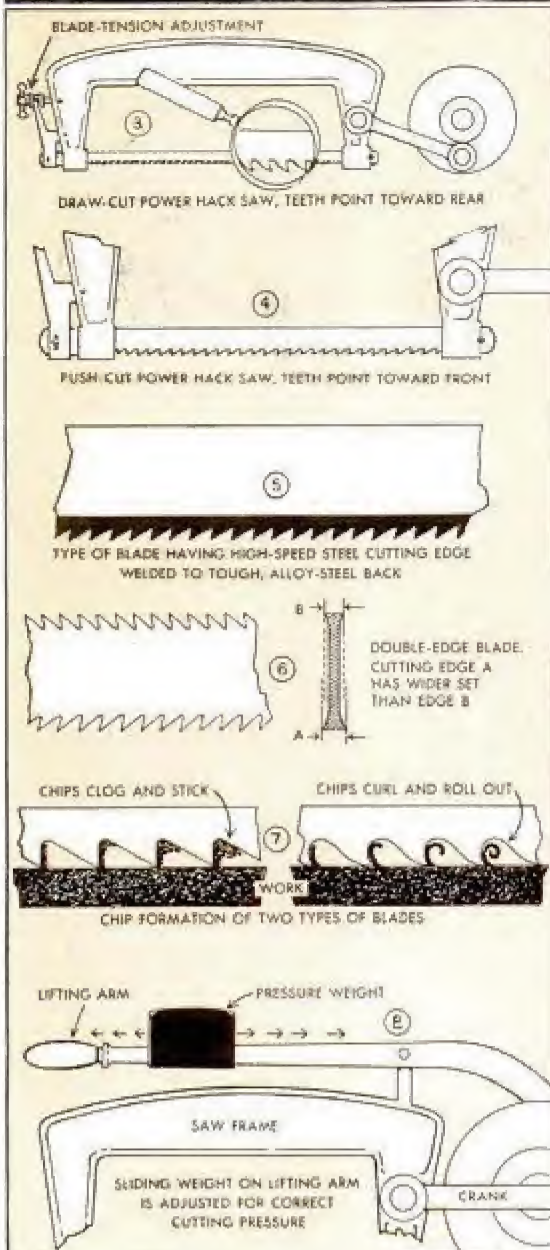
6 teeth per inch
Medium-size solid steel stock

10 teeth per inch
Cast iron; medium-diameter hard alloys; heavy angle trim, pipe and tubing; rails; soft steel; tool steel.

14 teeth per inch
Hard steel; bronze; wrought iron; medium-wall pipe and tubing; light angle trim.

18 teeth per inch
Thin, flat stock; light-wall tubing.

Note: Coarse-pitch saws of high quality can be resharpened at least twice



The most important things an operator of a power hack saw should know are the proper blades, the correct speeds and feed pressures on different metals

the stock, the finer the teeth; (3) no less than two or three teeth should contact the work when sawing thin stock; (4) as coarse a tooth as possible is used when not limited by restrictions 1 and 2. Other suggestions on blade selection are given in Fig. 2.

Feed pressure: Plain models of hack-saw machines have cutting speeds from 100 to 125 strokes per minute. Desired feed pressure is had by adjusting a weight back and forth on an arm positioned directly over the saw frame as in Fig. 8. A 40-lb. weight set at the extreme lifting end is equivalent to 80 lbs. of pressure on the saw. If the machine does not control pressure automatically, moderately heavy pressure is used generally. As a blade gets dull the pressure should be increased so that the teeth will not slip. It is customary to start with a pressure of 60 lbs. for hard materials and increase this to 80 lbs. maximum. For soft materials, the pressure may vary from 40 to 50 lbs. Too much pressure on soft stock causes teeth to jam and break. If a blade breaks while cutting, the work is given a quarter turn before using a new blade to avoid damaging the set by having the blade jam in the cut. After a blade has been inserted in the frame it is drawn up tightly, and after making a few cuts it is again tightened because it stretches slightly when used. The work should be set up so that the blade does not start cutting at too great an angle. All power hack-saw blades do not produce identical chips since the shape

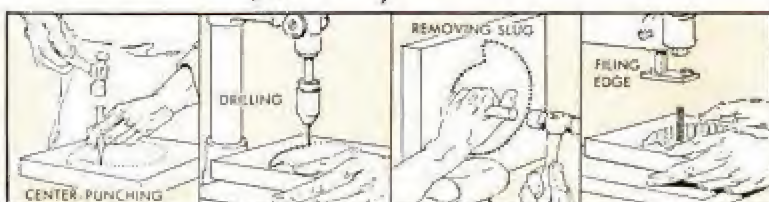


of the tooth gullet is a governing factor as shown in Fig. 7. With a tooth shape of maximum gullet and angle as shown in the right detail, a saw having more teeth per inch (finer pitch) can be used, especially if the material to be cut is hard. On the other hand, if a saw having teeth shaped as shown in the left detail is used, it is frequently necessary to resort to coarser tooth construction to avoid chips clogging in the gullets.

Speed and cutting lubricant: Average speed for sawing with molybdenum or high-speed steel blades, using no cutting lubricant,



Three outstanding examples of what can be done on a metal-cutting band saw are shown on this page. Note how the punch and die in Fig. 10 are produced, eliminating the four time-taking steps of the older method, Fig. 11



11 Old way



Photos courtesy Continental Machine, Inc.

varies from 75 strokes per min. for hard metals to 100 strokes for soft metals. For tungsten-alloy blades, decrease the above speed 35 to 40 percent. When using a cutting lubricant, dry-cutting speeds may be increased 25 percent, if advisable. Too fast a speed overheats blades and dulls teeth quickly. Generally the harder the stock, the slower the speed should be. Using a cutting lubricant not only permits increased speed but also aids in washing out chips. Use the lubricant whenever possible on any metals except cast iron, copper, brass and aluminum, but avoid using an excessive amount because a warm (not hot) blade cuts better than one that is cold. Slight steaming of the lubricant does not



Wrenches while you wait

Sharp band-saw blades produce chips of the formation shown in Fig. 13. Simple tools such as wrenches shown in Fig. 14 are cut out in record time and later hardened

indicate too high a temperature. The use of kerosene for sawing medium and large size aluminum castings and bars will lengthen saw life substantially.

METAL-CUTTING BAND SAWS

Metal cutting on a band saw is now regarded as a specialized form of machining and not only a cutting-off process. Sawing away material not needed does not involve waste in the form of chips as in turning, shaping and milling.

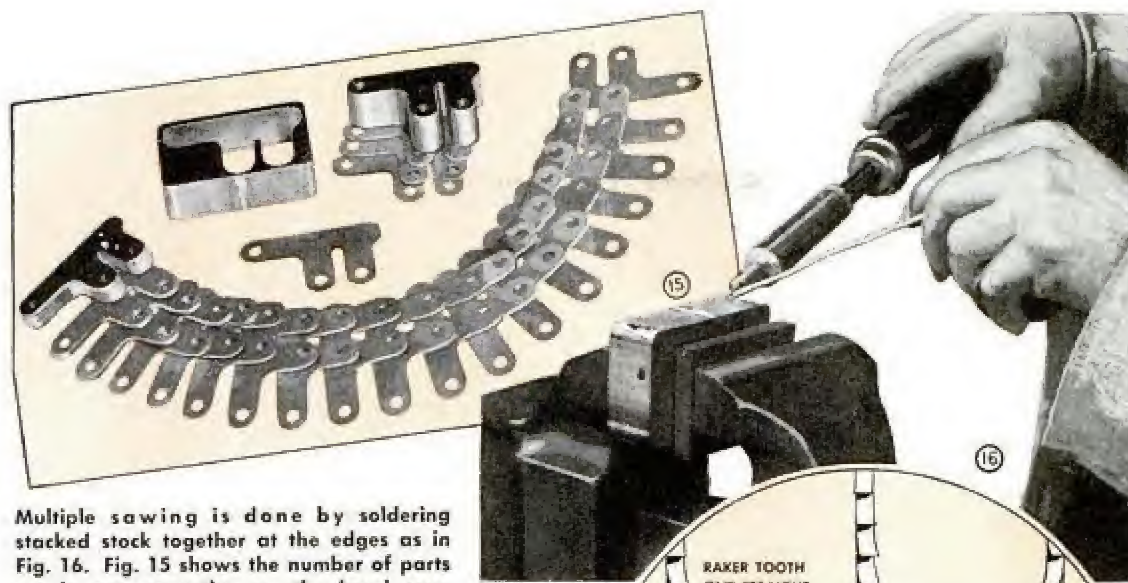
What can be done: Vertical accuracy of work cut on a band saw can be held to extreme limits. For instance, on the cam shown in Fig. 9, the height was 6 in., but the variation from top to bottom was only .002 in. Many other jobs are possible, such as cutting out metal grills, patterns and

gaskets. Another unusual accomplishment of the band saw is making dies and punches as in Fig. 10, which represents a considerable saving in time and labor, and also a saving of stock, over the old method which involved the four steps shown in Fig. 11. Parts that are usually forged often can be produced on a band saw, as the locomotive

poppet valve shown in Fig. 12. Another possibility is the making of certain tools, especially wrenches as shown in Fig. 14. By stacking sheet or flat metal and by either soldering or bolting the pieces together, depending on the thickness of stock and the type of work, many identical parts can be sawed out in one cutting operation. See Figs. 15 and 16. This method eliminates stamping such parts with dies.

Adapting wood-cutting band saw: Cutting metals on a band saw is as easy as cutting wood or other non-metals. Chief requirements are good saws and suitable cutting speeds. You can experiment with metal cutting on a wood-cutting band saw. First thing to do is to arrange a countershaft to be able to get the lower speeds needed, and then get some metal-cutting blades. For a 12-in. band saw, the arrangement shown in Fig. 19 will give suitable speeds for metal cutting. In

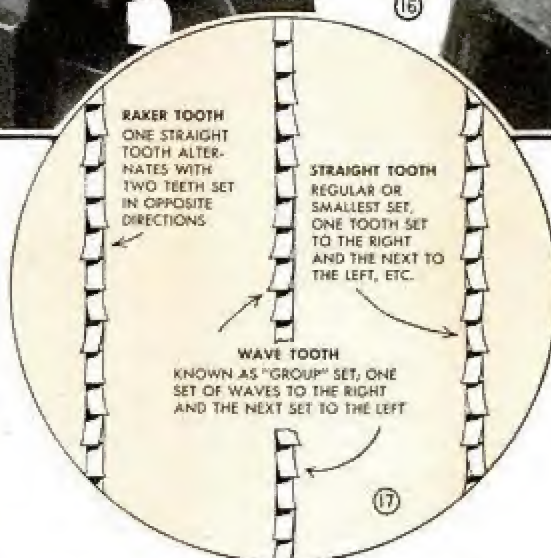
this case a 1,140 r.p.m. motor fitted with a 1½-in. V-pulley was used to drive a 7½-in. V-pulley on the jackshaft. Two four-step cone pulleys fitted with a V-belt, cut down the speed still more. The jackshaft is mounted on a 2 by 6-in. base, which is hinged at the edge facing the band saw, and the motor is also hinged in a similar way with the result that both belts have an even, adequate and lasting tension. With this arrangement the average saw-blade speed for wood cutting of 2,200 feet per minute (f.p.m.), can be cut down to about 285 f.p.m. Resulting speeds of the band-saw wheels (12-in. dia.) are 91, 171, 304 and 570 r.p.m., while the saw blade speeds are 285, 536, 954 and 1,789 respectively. (The latter speed is not used for metal cutting.) For the apprentice, cutting



Multiple sawing is done by soldering stacked stock together at the edges as in Fig. 16. Fig. 15 shows the number of parts cut in one operation on the band saw, eliminating the need of punches and dies

should be limited to soft ferrous metals under 1 in. in thickness and nonferrous metals not exceeding 2 in. in thickness. All work should be restricted to external cuts, meaning operations that do not require cutting the saw blade, inserting it through a hole and then welding the ends of the blade together again, as is done on internal cuts.

Blades to use: Correct speeds should coordinate with suitable blades for best results. The apprentice will need three types of blades as follows: (1) $\frac{1}{2}$ -in. blade with 6 teeth per in., (2) $\frac{3}{8}$ -in. blade with 8 teeth

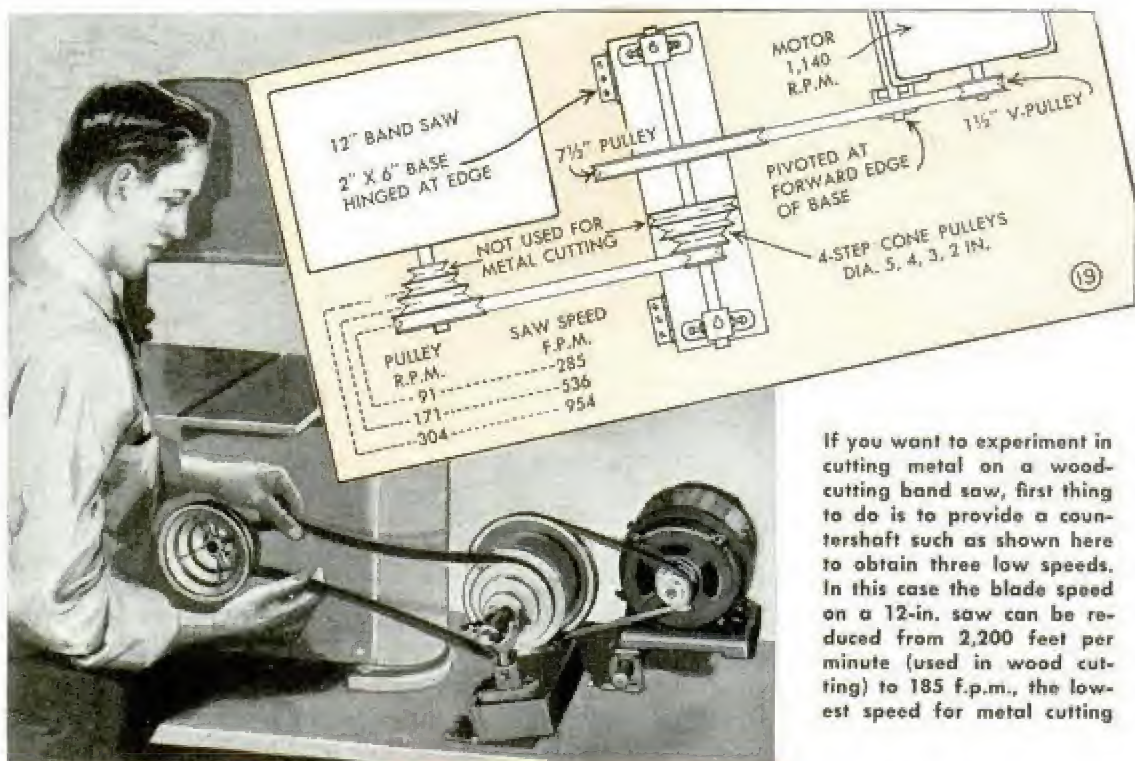


per in., and (3) $\frac{1}{4}$ -in. blade with 12 teeth per in. After some practice, one may use a $\frac{3}{16}$ -in. blade with 14 teeth per in. Fig. 17 shows three types of set on band-saw blades, available under normal conditions. The raker type is most readily obtainable. There are also two thicknesses of set, and although blades are standardized at .025 in. thick, widths of set are .032 and .042 in. The widest should be used as it gives the back of the saw more freedom. Blade selection to suit the job is similar to that on hack saws, the softer the metal, the coarser the teeth; also fine teeth for thin sections. General recommendations on blades for various types of metals are given in the table, Fig. 18.

Always use the widest blades for straight cutting. Where corners are involved, the $\frac{1}{4}$ -in. blade is of general purpose as all corners may be cleared by drilling $\frac{1}{4}$ -in. holes at these points. Work is prepared for cutting by polishing the surface, coating it with layout fluid or prussian blue and then scribing the outline on the surface from a

18 SAW AND SPEED SELECTIONS			
Material	Pitch (Teeth per in.)	Tooth Set	Saw Speed F.P.M. (Approx.)
Aluminum castings	6	Straight	500
Aluminum sheet and tubing	12	Straight	900
Bakelite and plastics	12	Straight	500
Brass castings	6	Straight	500
Brass sheet and tubing	12	Straight	900
Bronze castings	8	Raker	300
Copper	8	Straight	300
Cast iron	6	Raker	300
Malleable iron	12	Raker	300
Machine and mild steels	12	Raker	300
Pipe	12	Raker	300
Structural steel	6	Raker	300
Straight carbon steels	8	Raker	300

Note: Feed work easily when cutting at lower speed. These recommendations are strictly for home-workshop requirements and are not intended for regular machine-shop data or selections.



If you want to experiment in cutting metal on a wood-cutting band saw, first thing to do is to provide a countershaft such as shown here to obtain three low speeds. In this case the blade speed on a 12-in. saw can be reduced from 2,200 feet per minute (used in wood cutting) to 185 f.p.m., the lowest speed for metal cutting

pattern or template. In actual shop work, the outline represents finished dimensions and the operator must make allowance for filing down to size later.

Blade adjustment: Adjustment of the blade is highly important, make sure that the saw runs or tracks on both wheels properly. Then adjust the upper and lower guide pins or rollers against the side of the blade so that there is a slight clearance—.001 in. is sufficient. Be sure that the blade is neither squeezed nor bent when making the adjustments. Check the alignment of the upper and lower guides frequently. Saw-blade tension should be adjusted at intervals and excessive tension, which

causes blade breakage should be avoided. Thrust wheels behind the blade must be adjusted to work freely yet give support against the back of the blade so that the cutting edge plus $\frac{3}{16}$ in. of the blade projects beyond the guide blocks or rollers. Keep the rollers well oiled and when the machine is not in use release the tension on the blade. A suitable blade run at the proper speed produces chips as in Fig. 13. Do not apply too much pressure, especially when starting a new blade. Begin slowly until the blade conforms to the cut before increasing pressure. Too much pressure causes teeth to dull quickly.

Next month: The Drillpress and How to Use It

Grooves Around Sign Letters Keep Colors From Running



When working on wood or cardboard with contrasting showcard colors, one sign painter prevents the colors from running by outlining the letters or designs with tiny grooves by means of an ordinary ten-cent glass cutter. This compresses the surface fibers just enough to stop the colors, resulting in clean-cut edges.

Very shallow scratches can be removed from mirrors by rubbing the surface of the glass with a piece of hard felt that has been moistened in water and dipped in either red or black rouge.

Attaching Tags to Cloth Bolts

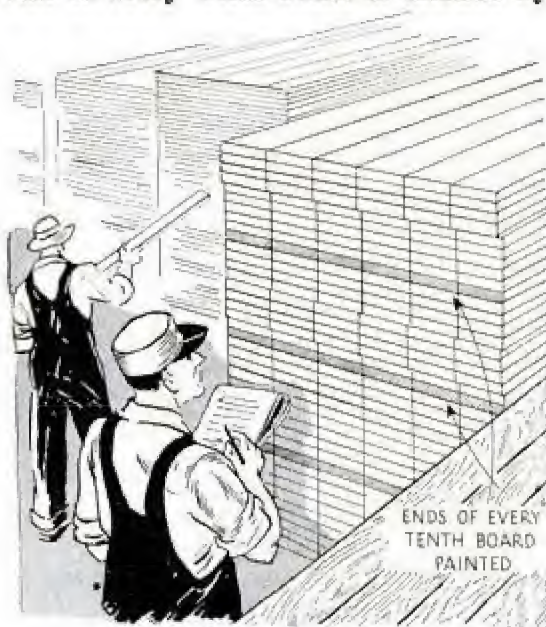


Attachment of sales or inventory tags to bolts of cloth may be done quickly with the aid of a small needle threader. The fine wire loop of the threader is pushed through the cloth easily, after which the string of the tag may be inserted through the loop

and pulled back through the cloth for fastening in the usual way.

Lumber Inventory Is Simplified By Marking Every Tenth Board

Time required for taking inventory in a lumber yard is greatly reduced when one end of every tenth board is marked by



painting it as shown. The painted ends clearly set off equal numbers of boards in a pile, making it an easy matter for the men taking inventory to estimate at a glance, the exact amount of stock on hand.

☛ When painting windows be sure to leave both sashes opened an inch or so until the paint dries so that they will be easy to move later on in case the paint causes them to stick.

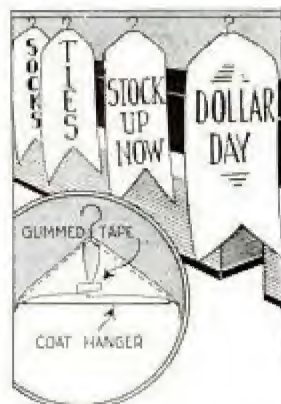
Pencil Clip Soldered to Oilcan Slips Over Edge of Pocket



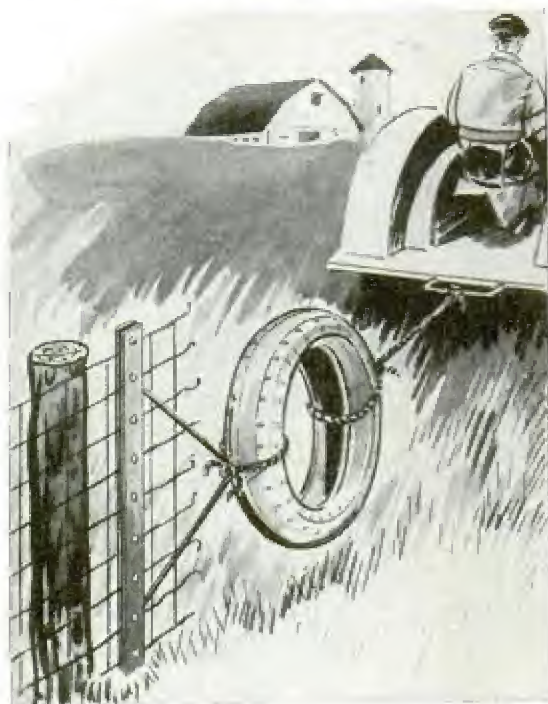
To overcome the difficulty of carrying an oilcan and using other tools at the same time while working from a ladder, one mechanic soldered a pencil clip to the oilcan so it could be hung over the edge of his pocket. A heavy clip was used and the band flattened before soldering.

Sales Banners on Coat Hangers Suspended From Store Ceiling

The manager of a store sale in which much of the indoor advertising was to be done with paper banners or pennants suspended from the ceiling, cut the banners to a width suitable for folding over wire coat hangers with which the banners were suspended. The folded corners of the paper were crossed at the back and fastened with strips of gummed paper tape as indicated in the circular detail.



Old Tire Absorbs Tractor Shock When Stretching Wire Fences

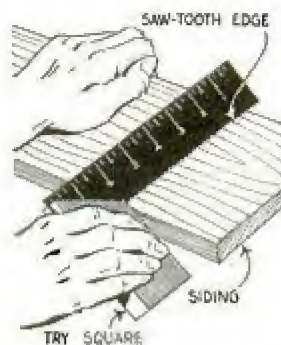


Tractors can be used to stretch woven-wire fences, without jerking the wire which might pull the corner posts or attaching

staples, if an old auto casing is used as a shock absorber. The casing is connected between the stretcher clamp and tractor draw bar. It provides just enough spring to exert an even pull on the wire.

Self-Marking Try Square

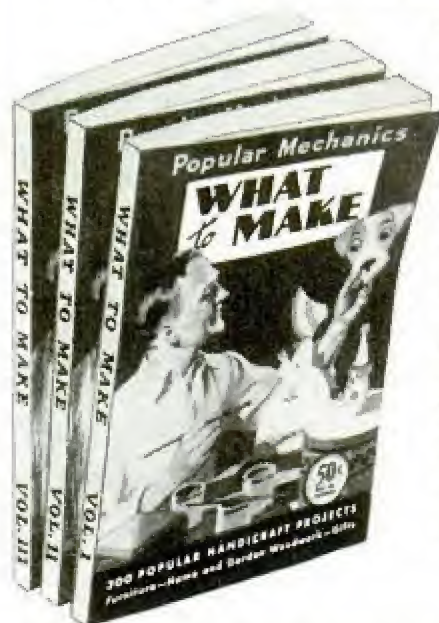
The difficulty sometimes experienced in holding both the work and a try square to mark the work while standing on a ladder or scaffold, caused one carpenter to make the square self-marking. The inside edge of the square was ground to a knife edge and then serrated with a file to form saw teeth. Held square on the work, the tool is then turned and the teeth forced into the wood to impress the cutting mark.



❏ If the threads of a saw arbor clog and bind, file a groove across them as deep as the threads themselves.

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Radio

More Radio Operators Trained for Uncle Sam

By S. Gordon Taylor

ENLISTED men and selectees at the Navy Signal Corps Replacement Center at Fort Monmouth, New Jersey, receive training which will likely prove highly valuable on return to civilian life, but in the meantime they are helping the Navy to meet its urgent need for radio personnel.

A concentrated training program turns out qualified operators ready for active service at ship or shore stations. In 16 weeks a man is capable of copying 25 words per minute, has developed a general familiarity with Navy transmitters and receivers, and the fundamentals. One large code-practice class appears in the inset photo.

Previous to December 7, the men did not have to depend entirely on letters to keep in touch with folks at home. Uncle Sam, thoughtful of his soldiers and their



relatives, established a completely modern amateur station, W2OEC at the Center under the supervision of 1st Lieut. Preston W. Sims for handling messages to and from the men in training, without cost to them. Two operating positions are shown in the top and bottom photos. This station formed a link in a chain of civilian stations.



LITTLE GIANT

By Frank M. Lund

STRIPPED of all unnecessary frills, this 1942 "Little Giant" low-cost a.c.-d.c. receiver is quite different from former models of this popular series that have appeared in the March issues of Popular Mechanics Magazine. Designed for economy and high-grade performance, it uses three dual-purpose tubes in a 4-tube superheterodyne circuit, with results equivalent to those obtained from five or six tubes on the broadcast, intermediate and short-wave bands. It includes automatic volume control, electro-dynamic speaker and a vernier tuning dial. Easier to build than some of the previous models, simple, inexpensive, open-chassis construction is employed and the chassis is insulated from the line. Six low-cost plug-in coils cover all bands; tone and volume are highly satisfactory, and the set is a real distance getter on both the domestic and foreign bands.

The dual-purpose tubes function as follows: the 70L7-GT is an output beam-power amplifier and rectifier; 12Q7-GT is an audio amplifier and duo-diode detector (2nd. detector); the 12A8-GT is the oscillator and mixer (1st. detector). Each plug-in oscillator coil has its own padder condenser built in and correctly set. The circuit is stable enough to use the 12K7-GT tube without a shield if desired, although it is common practice to use a shield on this tube.

The metal base is the same as used in the 1941 model, with one additional socket, and the 2-gang 365 mmfd. condenser is the same specified capacity, with trimmers. Complete base and panel details are shown in Fig. 1; the panel may be

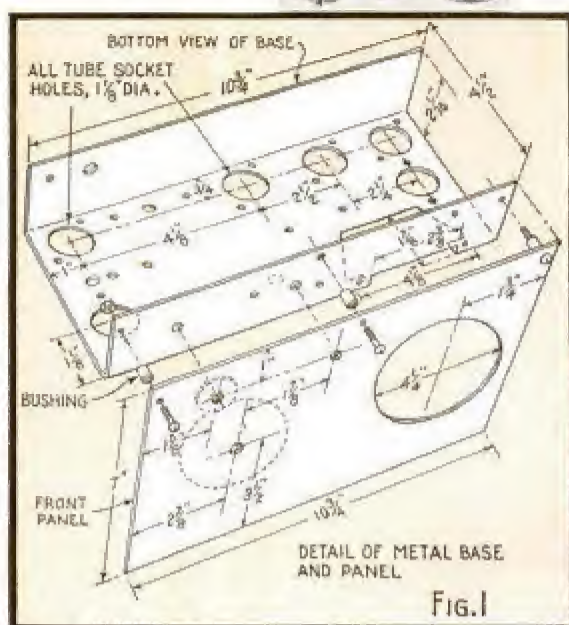


FIG. 1



A.C. D.C. THREE-BAND SUPER

ALL-WAVE TUNING RANGE

- (A) BROADCAST RANGE - 540 KC. TO 1720 KC.
(B) INTERMEDIATE BAND - 1720 KC. TO 5.7 MC.
(C) SHORT WAVE BAND - 5.7 MC. TO 18 MC.

made of hard pressed wood, plywood, Bakelite, or steel, offering a wide choice of materials. Please note that the panel is spaced out from the metal base by means of 3 metal bushings $\frac{1}{4}$ in. long, in order to provide room for the vernier dial drive disk just back of the panel.

A complete simplified wiring diagram, showing all connections below and above the base, appears in Fig. 2, and the schematic circuit diagram is given in Fig. 3, together with the plug-in coil chart. Photos A, B, C and D show various close-up views of the completed receiver; all parts are clearly identified in these photos. It

(Continued to page 180)

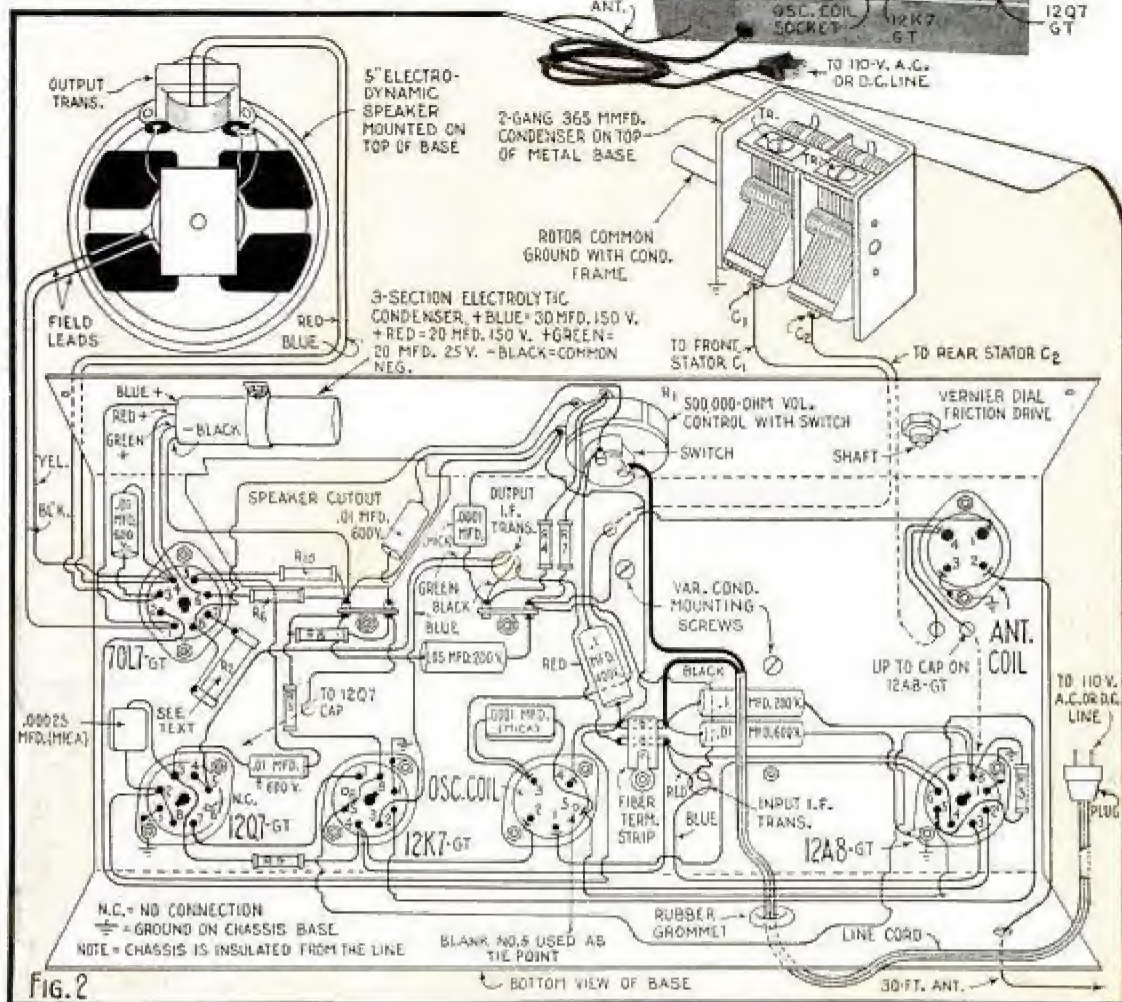


Fig. 2



"Wireless" Record Player From the Junk Box

BY E. L. BLANCHARD

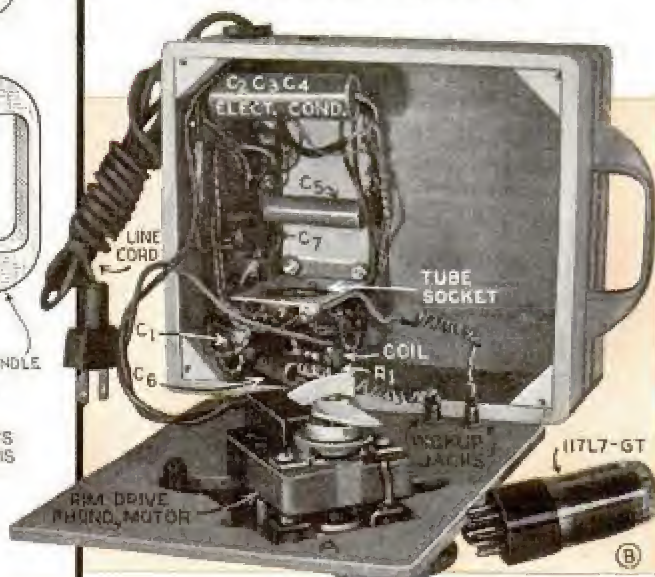
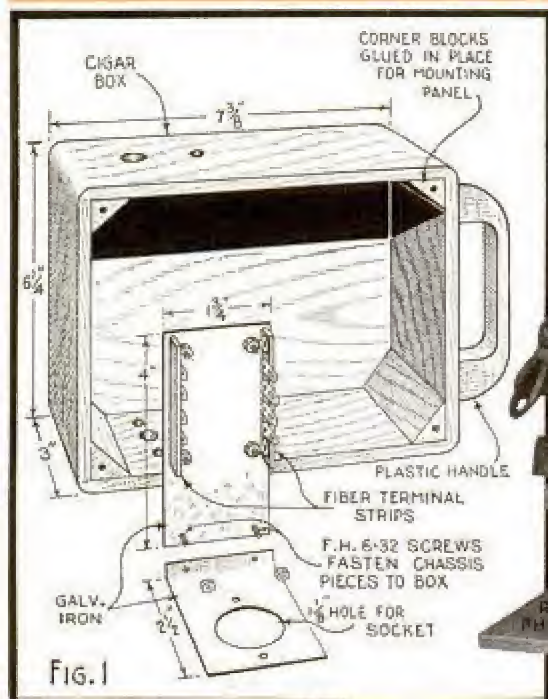
MOST of the parts for this "wireless" record player can be found in the average radio experimenter's junk box, with the exception of the small rim-drive motor, and crystal pickup, each of which costs about \$2.45. Housed in a cigar box covered with striped awning canvas, and weighing only 4 pounds, this diminutive "phantom" record player can be taken to parties for playing records through any radio.

The heart of the record player is the multi-purpose type 117L7-GT beam-power pentode tube. The pickup, instead of being permanently attached, plugs into the cabinet when the player is being used.

Construction details are quite simple as shown in Fig. 1 and photos A and B; the coil details and schematic circuit diagram are given in Figs. 2 and 2-A. The cigar box shown in Fig. 1, or a wooden box of similar dimensions, is provided with corner blocks, and a top panel which consists of a piece of 1/4-in. Masonite or similar pressed wood.

An opening large enough to accommodate the phono motor is cut in the top panel. The radio parts for the oscillator are all mounted on the L-shaped chassis cut from galvanized iron; two fiber terminal strips each with 4 insulated lugs, support all fixed

(Continued to page 183)

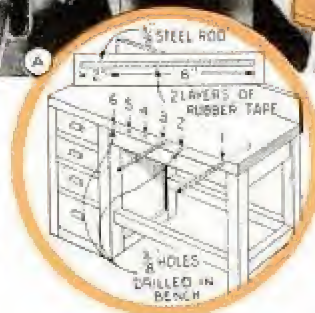
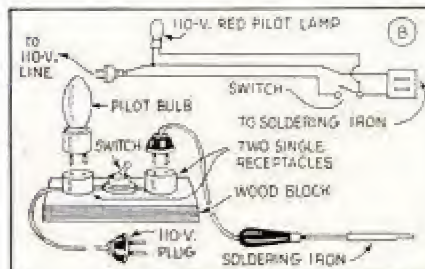


Practical RADIO SUGGESTIONS

(A) All radio experimenters and service men require some means for supporting receiver or amplifier chassis bases bottom-side-up on the bench for easy access to parts and wiring on the underside, without damaging the delicate parts and tubes mounted above. The method shown is highly efficient and costs practically nothing. Two or more 10 in. pieces of $\frac{3}{8}$ -in. steel reinforcing rod are inserted in holes drilled about 2 in. deep in the front edge of the bench. Holes 1 and 2 are spaced 8 in. apart, and the next four are 4 in. apart to accommodate bases of various sizes. All details are clearly illustrated in the diagram and sketch. The tape prevents chassis from slipping



(B) This pilot lamp arrangement provides a visual reminder that the soldering iron is being heated. The sketch and circuit diagram are self explanatory. When switch is open, lamp is out and iron is cold

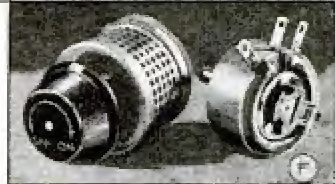


(D) To blueprint your charts and diagrams, make negative on architect's tracing linen. First rub fuller's earth or pumice over the glazed surface, then clean and use a sharp soft pencil. Place negative face down on printing frame glass, then lay blue side of blueprint paper on negative and clamp down

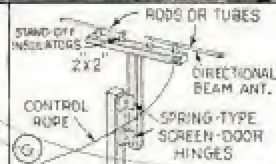


(C) Designed to fit all automatic and manual recorders, this brush keeps cuttings away from recording needle, thereby eliminating skips on record being made. (E) Spring clothespin makes handy vise for small soldering jobs. Supports work difficult to hold while soldering

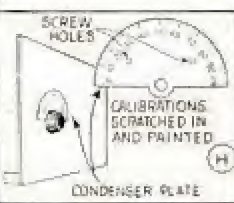
(F) Armored power rheostat designed for hard use under exposed conditions; 25 watt type is available in resistance values of 1 to 5,000 ohms. (G) Screen-door hinges of the spring-return type, used to permit one-rope control of directional beam receiving antenna



(I) High-frequency iron-core coils for permeability tuning, are compact, low in cost and eliminate need for aluminum condensers and shields



(H) Lacking a calibrated dial, a plate from an old condenser provides good substitute



Recordit Co. 555 Bedford Ave
Lb. Louis, Mo.

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Montgomery Ward & Co Chicago
Portable Set Has Drop Front

This 3-way, 6-tube portable is designed with a convenient telescoping drop front, and employs 325-hour self-contained bat-



*Lullabye Furniture Co
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 Chicago*
 teries for portable operation. It will also work on the usual 110-volt a.c. or d.c. power lines. Easy to read dial tunes from 535 to 1600 kc.; 9.0 to 18.3 mc.

Radio-Lamp in Aviation Motif

In following the aviation motif, even the dial knob is designed to resemble a propeller blade. The shade is decorated with a pursuit plane while the light bulb protruding above the shade resembles a beacon. Set is a 4-tube a.c.-d.c. type.



Photo-Cell Counting Assembly



Photoelectric units have been given many important jobs in which they supervise or record production output. The portable assembly shown is a complete conveyor counting unit that can be moved and installed quickly on another conveyor when necessary. Control box contains amplifier and relays. The boxes and counters can be operated at remote locations.

Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—Two and One-Half Meter Emergency "Walkie Talkie." Fitted with pack straps, a rod-type antenna and self-contained batteries, it provides a practical and easily portable means for short distance communication in emergencies. Also—A Low-Cost Automatic Line-Voltage Regulator for Receivers.

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OUTDOORS...INDOORS... you can always count on KODAK FILM

2770

Throwing Light on the Darkroom

(Continued from page 95)

asbestos. Roll film can be hung in the box lengthwise to dry; cut film attached to clips mounted on cross braces. A good print drier is an asbestos-lined box 18 inches deep, with a curved sheet-metal top the same dimensions as a ferrotype tin. Install four 100-watt lamps on the floor of the box.



Eccentric arm from electric motor is rigged up to rock developing and fixing trays for quick results

Heat from the lamps dries prints on the ferrotype tin that is held in contact with the top in 10 or 15 minutes.

Static electricity often causes dust and lint in the air to attach itself to the glass plates in which negatives are placed in the enlarging camera. If the camera is of metal construction, ground it with a copper wire running to a plumbing fixture. That will help. Better yet, build a negative frame that holds the film in the enlarger without any glass. The darkroom should be kept clean with a vacuum cleaner; some photographers hang large vaseline- or grease-smearred cardboard panels on the ceiling to trap dust and lint. Dust control is considered so important that at the Disney studio in Hollywood the photographers first walk along a waxed passageway and through an air blast before they enter the camera rooms. The atmosphere of these rooms is kept under a slight pressure and the air rushes out of the entrance doors, discharging any dust and lint with it, when one of the doors is opened.



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Rubber From Milkweed

(Continued from page 89)

needs for both civilian and military aviation. A survey disclosed 27,000 acres of milkweed in southern California alone, an acreage that, Sharpe says, represents 100,000 tons of milkweed from which about 50,000 tons of rubber could be extracted.

The inventor planted the weeds in rows in late October, harvesting the following July. The resulting crop averaged five pounds per plant and 28 tons per acre.

The weeds are pulled up while crisp and green, washed and crushed like sugar cane. The juices extracted are allowed to stand for seven days, then the liquid is siphoned off and stored. A culture of bacteria is then added. By their magic of fermentation the microbes evolve a new kind of rubber. The "cream" or latex appears in two days and is skimmed off in a thin sheet.

"When it is recalled the part that bacteria play in the making of cheese, cider and other food products," Sharpe explains, "it is not surprising that certain strains can produce rubber when cultures are added to vegetable milk. The bacteria multiply and eat the starches, converting much of the milk into protein. The secret lies in the curing; tiny globules are developed in the mixtures which impart elasticity to the latex. Nine-tenths of the milk can be converted into various grades of rubber."

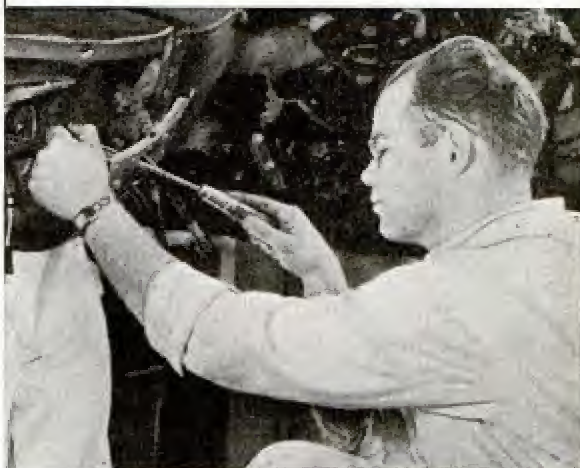
The latex is collected every two days. Then the cream is whirled in a centrifuge which removes excess moisture and foreign particles, and placed in a heated vacuum kettle. Chemicals and a deodorizer are added. After cooking an hour at 300 degrees Fahrenheit, the mass becomes smooth and plastic, about the consistency of heavy tar at the same temperature.

After cooking, the mixture is spread on metal trays and placed under infrared lights. After 60 minutes the mass is dry enough to mill, and is rolled into slabs like ordinary para rubber. The entire process of harvesting, processing and rolling requires scarcely more than three hours.

"High protein," explains Sharpe, "is very important, particularly for use in weapons of war. Whereas tree rubber contains an average of 1.5 percent protein, the bacteria protein in milkweed rubber is as high as 48 percent. This makes it resistant to freezing, acids and chemicals."



Supremacy in the air begins with Efficiency on the ground



In refitting engine cowling after major overhaul, this United Air Lines mechanic makes joint a tight one with a few touches of his Nicholson File.

NEVER has American youth had a more promising field for achievements in mechanical science than is offered by the vast aviation industry. Whether on war or commercial planes—whether in building or maintaining them—the ace mechanic rates with the ace pilot in importance. For he, too, helps to "keep 'em flying."

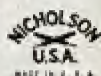
How to choose the right tool for every job and how to use it correctly are primary requisites—necessary for the efficiency demanded by an industry which leaves nothing to chance.

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X-Rays in Overalls

(Continued from page 46)

X-rays is as wide as American industry itself. In a western packing house an X-ray inspection unit tells good oranges from bad as they pass beneath a fluoroscopic screen. In others, X-rays detect foreign bodies or spoiled foods in containers.

All along the line from the low voltage instruments up to the million-volt "gun," X-rays have their particular jobs to do. Most spectacular, of course, is the biggest. Big in potentialities, though not in dimensions; for the million-volt machine has been tailored by the geniuses of General Electric company into a 1,500-pound parcel only three feet in diameter, four feet long. It is relatively as easy to roll in position as the X-ray your dentist pulls up to the chair for a peek through your teeth. It draws only four kilowatts of electric power.

Small in size, modest in consumption of current, it is ravenous in appetite for work. Because of its enormous power, it can be focused on its subject from a greater distance, thus cover a wider range of vision. Result: where it took six exposures to X-ray a heavy casting for a bombing plane at the Ford Motor plant with a 400,000-volt machine, the million-volt X-ray takes in six entire castings in one exposure. Where a half-inch crack in a weld four inches deep could be detected, the new machine shows up $\frac{1}{8}$ -inch cracks in an eight-inch weld. Until two months ago it took $7\frac{1}{2}$ hours to make an exposure of an area 12 inches wide; the same steel 24 inches wide can now be X-rayed in 15 minutes.

In short, the big X-ray can do the work of millions of dollars worth of radium—more than is available in the world.

In the General Electric plant, where turbines for the navy and other important defense machines are built, the big X-ray is used to take stereoscopic views, two pictures made from different angles giving a three-dimensional look through the wall of a large casting. Thus the exact location of any possible defect is made apparent.

Development of this million-volt instrument was made possible by three important innovations. One was the use of Freon gas under pressure as an insulating medium. At first air was the insulator, then oil; 100 pounds of Freon performs the insulating task of 12,000 pounds of oil.

The second development was the "resonance" transformer. Ordinary transformers consist of two coils of wire wound on an iron core. In the resonance transformer the iron core is omitted; the secondary—the coils from which high voltage emanates—has several hundred thousand turns, giving it high inductance. Without the iron core, insulation problems are simplified and the transformer's tank diameter is one-third less. Furthermore, it can be operated in any position, giving the tube greater flexibility and mobility.

Third innovation is the tube itself, which consists of twelve sealed-off sections. Electrons producing the rays emanate from a heated filament at the top, and as they flow through each section they are given a fresh jolt of about 84,000 volts. By the time they hit the bottom section of the tube they have accumulated a million volts. Then they hit the tungsten target in an extension of the tube projecting from the bottom of the tank, and produce X-rays. Most of the rays pass through the target and proceed in the direction the tube is pointed, so that ordinarily the tube is aimed like a gun at its object.

Nearly 20 years ago industry first put X-rays to work, when apparatus was installed in the government's Watertown Arsenal. In the years since it has played a vital part in the onward march of aviation, helping aircraft builders adapt aluminum and other light metals to engines and structural parts requiring lightness with strength. It made possible the substitution of welding for riveting in high-pressure boilers and other heavy products by serving as the welder's "second sight," enabling him to lay down welds stronger than the parent metal.

Now the million-volt X-ray has put on its overalls in the aircraft plants of the Ford Motor company, the boiler works of Babcock & Wilcox, the Combustion Engineering company factory, and in its own home plant of General Electric at Schenectady. It is going to work soon at the American Steel Foundries and the Campbell, Wyant and Cannon Foundry works, and, focusing its appraising eye on big guns and battleship armor at the Norfolk and Philadelphia Navy Yards, will play a great part in making America's defense invincible.

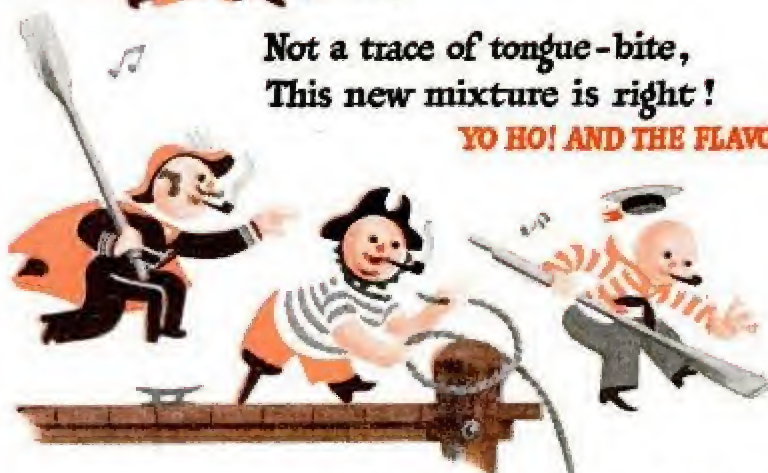
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YO HO! AND THE FLAVOR OF RUM!



**Not a trace of tongue-bite,
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YO HO! AND THE FLAVOR OF RUM!



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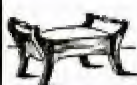
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How to Cut Your Heating Bill

(Continued from page 37)

the windows protected with storm glass.

Three and five-eighths inches of rock wool insulation is used in the Electric Skin House. The heat loss through this insulation is retarded to about one-sixth of what it is through any other part of the wall. Without the insulation it would cost \$65.90 a year in heat lost through the walls, thus making them the number one source of heat loss. As it is, the cost per year or heating season is \$16.00 making a saving of \$49.90 or 72.6%, the biggest saving to result from installation of any of the heat-saving devices under consideration. Only 22.2% of all the heat lost from the house is through the insulated walls.

By installation of adequate insulating protection in the ceiling and attic, the heat loss was reduced from \$26.50 to \$7.56, a saving of 71.4%, thus bringing the attic as a source of heat loss down to fourth place. Because of the insulation only 10.5% of all heat escaping is through the attic.

The balance of the heat loss is through the floor of the basement and the doors. Loss through the floor is 7.1% of all heat escaping; loss through doors is 4.8%.

What can the average person who is interested in cutting his fuel bill do?

He can start out first by making two interesting and simple tests of the heating-worthiness of his home. One is the test for blankets of heat and cold in his home. If his home is uninsulated and unprotected by weather stripping and storm sash, the difference in temperature between floors and ceilings of the rooms will be large.

On a zero day when the main inside wall thermometer of his home shows the temperature in the house to be 70, let him get an extra thermometer and hold it to the ceiling at an outside corner of his living room. After getting the reading at the ceiling, take another directly below at the outside corner of the floor. What will comparison of the two readings reveal?

In the Electric Skin House this test shows that the average "differential" between ceiling and floor in this "coldest" corner of the living room is only 4 degrees F. Mr. Wunderlich has made the same test in 50 other homes not so well insulated or protected from heat losses as his own. He has found these floor-to-ceiling tempera-

21227
ture differences to range between 12 and 18 degrees, differences three and four times greater than in his own home.

What's the answer? If any dweller finds such large differences in his home, he has not only uneconomical and wasteful, but uncomfortable and unhealthy heating.

The second test is for stairway drafts. In the average two-story home with uninsulated attic there is a large flow of warm air upward, and of cold air downward, between floors. A good part of this upward-moving heat is lost through the roof. To test for the presence of this draft, simply place two lighted candles on the steps, one on the top step and one on the bottom. Then watch the flames! Do they flicker? Lean in the direction of the strong air current? If they do, the dweller has his answer to compare with the same test made in the Electric Skin House. In the candle test there, the flames stand straight up. There are no drafts.

If a home-owner or dweller feels a good part of his heating dollar is going to heat the outside rather than the interior of his home, he can do these practical things:

If his home is unprotected by storm windows, he can put them on right away. By doing this he will save: 15 cents out of each fuel dollar if his home is not otherwise protected by insulation and weather stripping; 28 cents out of each fuel dollar if he has all other protections excepting storm windows; 63 cents out of each dollar's worth of heat lost out of his windows.

If his home is unprotected by weather stripping, it would be a good idea to plug up the cracks around his windows and doors. Installation of weather stripping will save him around: 9½ cents of each fuel dollar if this is the only safeguard against heat losses he employs; 20 cents out of each fuel dollar if his home is protected with "storms" and insulation; 46 cents out of each dollar's worth of heat escaping through all window and door cracks.

If his home is unprotected by insulation and he believes his fuel costs excessive, he should call an insulation specialist or heating engineer and talk over these points:

About ceiling and attic insulation—10 cents out of each fuel dollar can be saved by installing it if wall insulation and all other safeguards are not present; 13 cents

(Continued to page 168)

Tough

BUT OH SO GENTLE



TOUGH ON OIL-PUMPING, GENTLE ON CYLINDER WALLS

● Now, more than ever before—you can't take chances on undue engine wear. Fortunately, it's both simple and inexpensive to protect your car's engine—to insure maximum life and performance.

At the first symptom of ring wear get Hastings Steel-Vent Piston Rings. They stop oil-pumping, and check cylinder wear.

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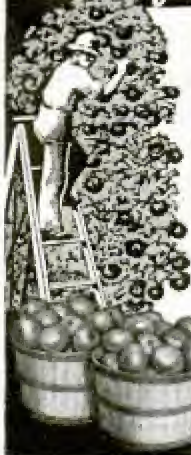
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2 or 3 vines will produce enough tomatoes for the average family.

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saved if only the attic is insulated and "storms" and weather stripping are already in use; 20 cents if attic insulation is all that has to be added to completely safeguard the house; 71 cents out of each dollar's worth of heat lost through the attic.

About wall insulation—27 cents out of each fuel dollar can be saved if this is the only and single precaution taken; 35 cents can be saved if weather stripping and "storms" are already being used and if attic insulation is absent; 41 cents if wall insulation is all that has to be added; 72½ cents out of each dollar's worth of heat lost through the walls.

Combining the benefits to be derived by a complete insulation job, including protection of both ceiling and walls, it can be concluded that this will save nearly 49 cents out of each heating dollar if the house is already protected by "storms" and weather stripping; nearly 37 cents if the house lacks these additional protections.

The average man can cut his annual fuel bill 61.5% in an entirely unprotected home by installing the four safeguards against heat loss—storm windows, weather stripping, attic insulation and wall insulation.

Kilowatt—The New Hired Hand

(Continued from page 43)

and healthful rays. The brooder may be operated effectively on a thermostat to maintain a constant temperature.

Mr. Kilowatt, our hired hand, can play a big role in the operation of the milk house. Before the advent of "wired helpers" on one farm, three men did the milking by hand, each requiring 80 minutes, a total of 240 minutes per day; now one man operating an electric milking machine does the job in 135 minutes a day, resulting in a saving of about \$42 per month in hired help cost. In the old days 12 hours a month were used in carrying milk utensils between the barn and the house for cleaning. Today an 80-gallon electric water heater in the milk house eliminates these trips by providing 894 gallons of hot water at a cost of \$3.42 a month. The time for washing the utensils in the milk house is about the same as that formerly used in carrying utensils to and from the house.

An 80-gallon electric milk cooler chills the milk below 50 degrees Fahrenheit in

(Continued to page 171)

if you're a PIPE SMOKER you may...like *ERICSSON*... Make a Discovery



Deep in their hearts, many pipe smokers feel that they're missing something by way of fine tobacco. . . . If you're one of these many, why not do a little "discovering" on your own? Very likely, Peper's Pouch Mixture will be a real find. Mr. W. E. Anderson thinks so—he says: "It has what it takes to make a fine tobacco . . . mildness, aroma and body." At your tobacconist's for only 25¢.

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So-Lo

an hour, not only preventing loss due to milk souring, but assuring ready acceptance, even when there is a surplus of milk. In one year the milk cooler cut \$32.30 from expenses by "saving" milk and taking the place of ice. An electric sterilizer is used to rid the dairy utensils of bacteria.

Bacteria in the air of milk houses, animal pens and of places where food is prepared can be kept to a surprisingly low count by means of a tubular lamp emitting "killer" rays. This equipment is useful in the cow barn, the horse barn, pig pens, poultry house and others—because animals and poultry will be healthier in clean air.

Portable electric motors are the answer to many of the farmer's problems. On one poultry farm before electricity came, feed was ground with a large grinder run by a tractor. Two men were required to run the outfit, the operation of which meant taking the tractor out of the field, frequently at busy seasons. Today a small hammer mill, driven by a two-horsepower portable motor, does the work. The grain is fed to the grinder from overhead and the ground feed is blown into another overhead bin—semi-automatic operation. By the old method tractor fuel to grind a ton of mixed grains amounted to \$1.17; electricity to grind a ton of the same grains costs 32 cents.

The portable motor can be prepared easily by the nearest blacksmith; an electric motor of the power desired is mounted on a small wheeled truck that can be rolled from one place to another to perform dozens of jobs—grain and corn elevating, grain and seed cleaning, hay hoisting, hay baling, corn husking, shredding and shelling.

Filling the silo is one of the important activities of stock farming. On one Wisconsin farm, the silo holds about 250 tons of ensilage. At first this farmer hired a man who furnished gasoline-power equipment and a cutter; he also boarded the crew and teams and furnished the gasoline to run the engine, running the cost up to 25 to 50 cents per ton for filling the silo. Then the farmer purchased a portable 7½-horsepower electric motor and cutter. On a test run he put ensilage into the silo for only two cents per ton, a saving of at least 23 cents per ton. In addition, the motor can be employed for many other tasks.

It can well be said that the farmer's best friend is an electric motor. A one-horse-

(Continued to page 172)

MONEY MAKING OPPORTUNITIES

A New Hobby that Makes Money at Home



HOW WONDERFUL it is when we can turn our interesting hobbies into cash. And it is possible! Brush electroplating offers the opportunity. Right at home some make a good living—as much as \$30 or \$40 a week. Here's what one

home electroplater of Chicago says: "I bought my electroplater to experiment with during my spare time. In a few evenings I earned the cost of the machine by plating jewelry, silverware, headlight reflectors, etc., for friends and neighbors. Now I have all I can do. I recommend this machine to all who want a profitable business."

This man apparently finds business easily. So can you. Besides the articles he lists there are electrical appliances, surgical and dental instruments, restaurant silverware, boat hardware, musical instruments and many automotive parts.

J. J. Wilson, Slidell, La., writes: "After I received my electroplater I practiced for about an hour. I made up four samples and went out after business. One of the large chain restaurants now has me do all their silverware."

Max Hemmert, Idaho Falls, Idaho, states: "I am now spending all my time in plating work. I purchased a brush plater last summer and have worked up a very promising business."

Frank Welde, Philadelphia, goes after garage business. He writes: "I electroplated a few brass strips for samples. I then showed these strips to different people and that's how I got plenty of jobs. I have all the work from a big garage. The owner gets 10% of what is charged his customers, and the rest goes to me for my work."

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power motor can do the mechanical work of eight men, yet it works all day at a cost less than that of the food one man eats at a single meal. Many machines can be driven with small—fractional horsepower—motors. These motors can be used to drive a multitude of small devices, pumps, clippers, grindstones, corn shellers, power tools in the farm workshop, etc. It is as bad to provide a motor with ten times the power required of it as to buy motors too small for their jobs. Good advice on the motors the farmer needs can be obtained from the county agent or the equipment dealer.

Not every farmer needs the amount of equipment installed on a large farm in western New York for experimental purposes, but he may get an idea of what can be accomplished with electricity and certain kinds of apparatus. Electricity had been used after a fashion to light the house and outbuildings, operate the radio and an electric iron. To existing wiring and fixtures, this equipment was added: about 5,500 feet of No. 12 or larger wire of low resistance; 80 new lamp outlets and 69 convenience outlets in the house, main barn and other farm buildings; nine motors with a total output of approximately 14 horsepower, operating silage cutter, hay chopper, hammer mill, hay hoist, wood saw, water pumps, one ventilating fan in barn, one in milk house and one in poultry house, milking machine, electric drill, paint-spraying machine, concrete mixer, cooling compressor; three bacteria-killing lamps; milk cooler; milk-house sterilizer using 3,000-watt heating unit; two 2,000-watt 80-gallon electric water heaters in milk house and home; battery charger.

In the farm house: electric refrigerator, combination sink and dish washer, cabinets and working surface for all-electric kitchen, electric roaster, 1,000-watt electric iron, electric ironing machine, electric range with double oven, mixer, toaster, fan, waffle iron, heating pad and coffee maker, three new floor lamps, three table lamps and six "pin-up" lamps.

Two years after installation, electricity had saved this farmer \$500, including the elimination of annual expenditures of \$50.35 for ice and \$96.40 for cook-stove fuel, freeing a hired man from dairy operation, replacing a part-time hired girl and increasing the farm production. And the family enjoyed life more than ever before.

The Battle for Safety

(Continued from page 69)

gone three years without a lost-time accident. *at the end of Columbia*

The Bayuk Cigar plant in Philadelphia established a new American record when its employes reached 14,314,436 work hours before a lost-time accident occurred. The United States Steel Corporation and its subsidiaries has brought its accidents per million man-hours down from 79 to 6.84 since 1913. The Jones and Laughlin Steel Corporation's seamless tube department



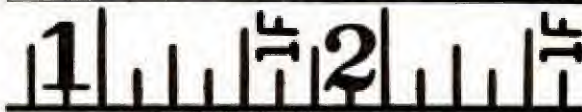
Asbestos-clad worker taps an open hearth furnace

rolled up 28,000,000 man-hours without a fatal work accident, while in the same period, 12 employes met death by accident outside the plant.

In the front lines of the battle for safety is the National Safety Council. This organization has found the ten safest industries are tobacco, cement, laundry, steel, glass, automobile, textile, rubber, chemical, and printing and publishing, with disabling injuries ranging from 2.77 per million man-hours in tobacco to 8.81 in printing and publishing. The ten most hazardous industries are paper and pulp, tanning and leather, woodworking, marine, clay products, foundry, refrigeration, construction, mining and lumbering, ranging on the same basis, from 15.38 to 45.50.

Analysis of industrial accidents by the council showed that more than one fourth were caused by plain carelessness. Of the mechanical causes, hazardous arrangement of machinery led the list, with lack of safety guards next. Other contributors were defective machines, unsafe apparel and scanty illumination and ventilation. Improper attitude toward safety and lack of

(Continued to page 174)



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Louis P. Wadowick says: "I have filed 704 saws in spare time."

Thor Nedribe, Iowa, says: "I have filed 550 saws, made \$350. As I'm a Carpenter, I just file saws in spare time—have more than I can take care of." With a



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knowledge or skill had some part in 85 percent of tabulated accidents.

Finger injuries were 22 percent of the total. Other portions of the body in order of vulnerability are the trunk (20 percent), legs, arms, feet, hands, head, toes, and eyes (4 percent).

Leonard Cole, Safety Engineer for the Crane Company, and member of the National Safety Council, offers five "don'ts" for workingmen: don't fail to use safety appliances, don't touch a machine until you know how to use it, don't get thoughtless or indifferent while on the job, don't try short cuts when there is a safe way of doing a job and don't leave tools and machinery around the floor for someone to trip over.

The army of skilled workers forms a tremendous asset and this investment should be protected, L. S. Hawkins, Director of U. S. Vocational Training for Defense Workers, points out.

"During the past year, more than one million men and women were trained for the defense industries in vocational schools," he says. "Ten times as many already have been trained in pre-employment courses as were trained during World War I. It is apparent that a considerable investment in the training of an individual may be entirely destroyed through an accident.

"The great majority of accidents result from the failure of some individual rather than from causes which cannot be foreseen. Induction of many new workers tends to increase these hazards unless appropriate measures are taken to guard against them. Accidents can be reduced through organized training programs and safety devices not only for the good of the worker, but to protect the public's interest.

"It is much more humane and more economical to take every possible precaution to protect the worker than to prepare a replacement. Safety training and safety precautions are an indispensable part of the defense effort."

If you spent fifteen minutes reading this article during normal working hours, the chances are at least two men went to their deaths in an American plant or factory—crushed by falling metal or stone, dragged into a whirling machine, burned, mangled or fatally infected. From 160 to 180 men were injured.

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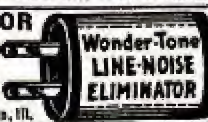
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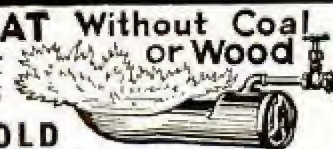
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Color at Work

(Continued from Coloroto Section)

consider light at every step in their work. If dark colors are used in home or office, more lamps will be needed. The effect of artificial light on color also must be considered. Texture, too, is important. Silks and hard-surfaced paints will show highlights, while wools, velvets and flat paints diffuse the light, resulting in entirely different color ensembles.

The whole trouble in dealing with color

is not so much man's misuse of it, but his failure to use it. Most people dodge the problem of what color to use by not using it. The result has been drabness. People know few colors and are reluctant to try something different. But we may expect to see vastly more color and colors employed intelligently within the next few years. In fact we have crossed the threshold from a taupe age to an era of color.

The Truth About Lightning

(Continued from page 85)

Faraday who in the early 19th century recognized that in any space which is completely surrounded by metal, there can be no electrical effects regardless of what is done to the cage itself or outside of the cage. For this reason steel buildings, steel trains, steel buses and automobiles are safe places to be in a storm. Although a bus or an automobile may not be grounded and is usually insulated from the earth by its rubber tires, if it has a steel top, it is a Faraday cage and no harm will come to a person inside it.

People usually think of lightning in terms of voltage. Actually, it is the current which passes through his body which injures him. To produce current in any part of a person's body or through any electrical conducting material, a difference of voltage must exist across it. The current which flows through the body is proportional to this difference in voltage. If a person is sitting in an automobile and it is struck by lightning, the voltage of the car will rise to a high value, possibly 200,000 or 300,000 volts, until the current flashes over from the car across the tires to the ground. The person sitting in the car likewise will rise to a high voltage, but every part of his body will have the same voltage so that no current will flow through him—and he will not be harmed. If, however, a person were standing on the ground and touching the car when it was struck, then a difference in voltage would be produced in his body, due to the fact that his feet would be on the ground and the part of his body touching the car would be at high voltage. Under these conditions he probably would be killed. This consideration is important when live wires fall on an

automobile. You should remain in the car, not try to get out.

In the early days of lightning rods it was because the importance of providing a good ground was not realized that the rods were not effective. Today, however, there are thousands of farm buildings and homes being effectively protected by this means. The importance of adequate grounding cannot be overstressed. After lightning strikes a rod and its charges flow down it to earth, they must seek out the charges of the opposite sign on the earth's surface. These charges may be distributed over a wide area and a stroke current may have to travel over a considerable distance of the earth's surface to reach them. If an adequate path is not provided for these enormous currents into the earth by the conductor on the lightning rod, a stroke may find a better path by flashing over some part of the building, causing fire or other damage. It is very important to connect the lightning rod ground to the water system, the telephone system ground and the ground of the electric light system.

As more knowledge of the characteristics of lightning has been obtained, engineers of the Westinghouse Company have learned how to reproduce correctly lightning in the laboratory and by the use of small models of transmission lines, farm houses and the like, have determined the correct location of ground wires, lightning rods and other protective means.

Any object taller than a person, such as a church steeple, a water tank or a tower, acts as a lightning rod and will shield him from being struck, if he is close enough to it, as long as the object has a sufficiently good conducting path to earth.

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Glass "Eyes" Give Super-Vision

(Continued from page 75)

Also developed in the Bausch and Lomb laboratories is a stereoscopic map projector used by U. S. military forces. By the use of overlapping photographs, transferred to glass plates, one lighted green and another red and viewed through spectacles with green and red lenses, a three-dimensional effect is obtained, so realistic that it appears possible to put one's finger on a smokestack, although it has been reduced to 1/25,000 of its real proportions.

As the result of the research of this company, which was awarded the Ordnance flag and Navy "E" pennant for outstanding production of naval ordnance instruments, military commentators believe the United States navy now leads the world in development of fire control instruments on warships, with Germany second and Great Britain third. These range-finder instruments are closely guarded secrets, yet it is known they have grown so complicated and precise that a range finder may consist of 1,500 mechanical parts with almost 100 lenses, prisms and sections of optical glass. It takes half as long to build a range finder as it does a towering battleship, but when they are finished neither the shock of thundering salvos nor the vibration of engines affects their use.

Also brought up to a new standard of efficiency are the range finders for huge coast-guard guns, antiaircraft detectors, height finders and military binoculars, which are subjected in testing rooms to man-made hurricanes to make certain weather will not cause failure.

What is termed the first major advance in optical glass since 1886 has just been developed by the Eastman Kodak Company. The entire production is being turned over to the U. S. military air service for mapping and observation purposes. The glass is made without silica, which is comparable to making steel without iron. It is characterized particularly by high light-bending ability with a minimum tendency to spread light out into a spectrum, and gives greater lens speed.

Improvements in the use of polarizing methods, in which an inserted sheet of film acts like a picket fence, excluding from lenses the rays which cause glare, have also resulted in assistance to the armed

296 3

forces. Laminated Polaroid lenses have been devised which can be ground and polished to such a degree of precision they can be used in fire-control instruments. The filtered rays are so precise that a light projected through these lenses would be refracted less than a yard at a ten-mile distance.

Reduction of glare is also proving an important factor in submarine and torpedo detection, since the polarized lenses cut through the surface reflections of water and disclose what is beneath.

Nor have the discoveries been confined to movies and war, for thanks to the combined research of Dartmouth University Eye Institute and the American Optical Company, a condition which has puzzled generations of eye specialists has been remedied. Thousands of cases were encountered in which the fitting of new lenses to defective eyes failed to clear up headaches, dizziness and even upset stomachs, until it was learned that all people do not see equal images with both eyes and the difficult task of adjusting one image to the other was raising havoc with their nerves, though their sight might appear perfect. The disease was called aniseikonia. American Optical Company scientists have devised a lens that corrects the condition, modifying the image as seen by one eye.

Although Benjamin Franklin gets the honor of inventing the first bifocal lens in 1775, when he simply cut two sets of lenses in two and put the thick reading glasses in the bottom of his spectacles, it is only recently that bifocals, which correct near and distant vision in the same pair of glasses, could be manufactured without leaving a fuzzy area where the two types of glass were joined.

Dr. William Feinbloom of Optical Research, Inc., in New York City, has won a science award for combining plastic rims with glass lenses in contact lenses, which are fitted directly to the eyeball.

Another New York eye specialist, Dr. Brittain F. Payne, devised the spectacles for color-blind motorists. The upper segment of the spectacles is red. Looking down the street, the motorist sees only the red or orange light, which warns him to stop or slow down. The green signal is never visible, so when no light is seen, the motorist knows it is all right to drive on.



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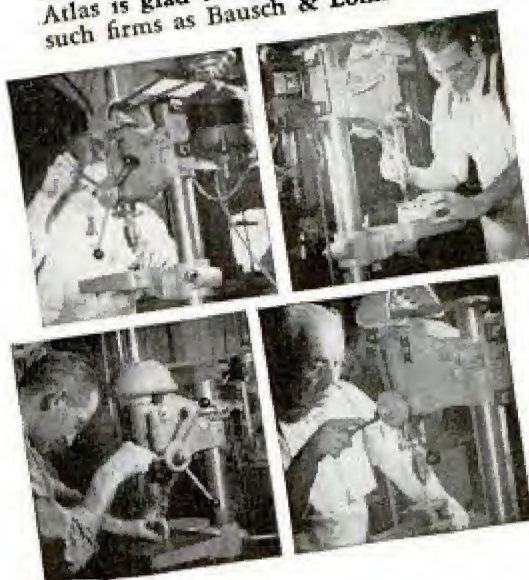
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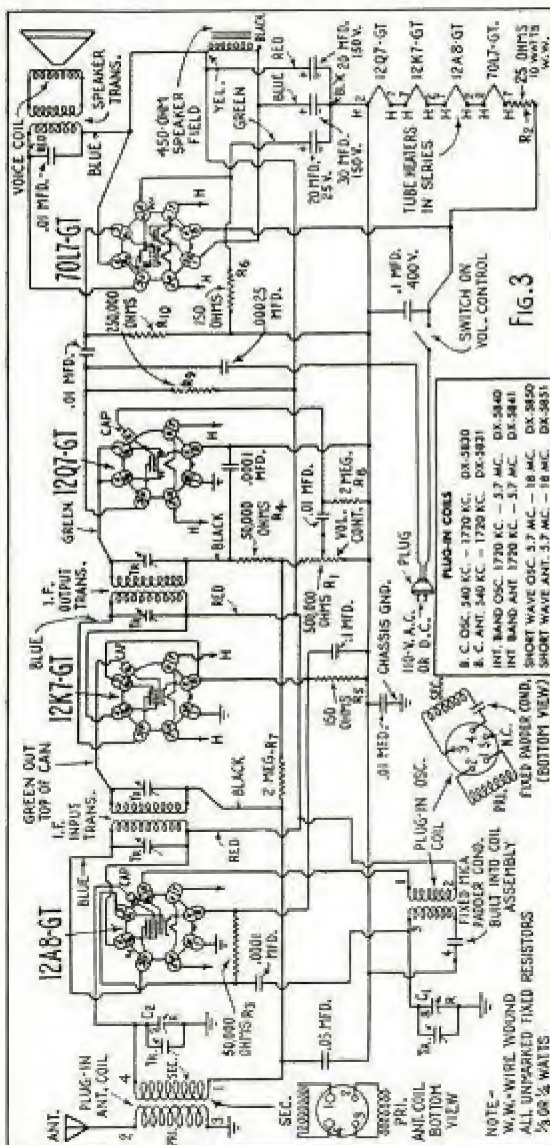
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1942 Little Giant Receiver

(Continued from page 157)

will be noted that the speaker is mounted directly on the chassis base behind the large hole cut in the front panel. This speaker opening is backed with lightweight grill cloth, cemented or glued to the back of the panel. The input and output I.F.



transformers are 456 kc., types DX-5826 and DX-5827 respectively, just as specified in the 1941 model.

The 5-in. electro-dynamic speaker has a 450-ohm field and requires a 2,000 ohm speaker output transformer to match the 70L7-GT tube. Fixed resistor (R_2) is a 25-ohm 10-watt wire-wound variety. The dial is a Crowe 4-in. frictional drive disk

(Continued to page 182)

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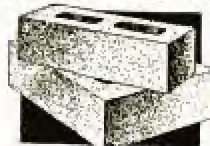
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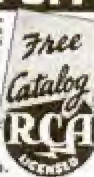
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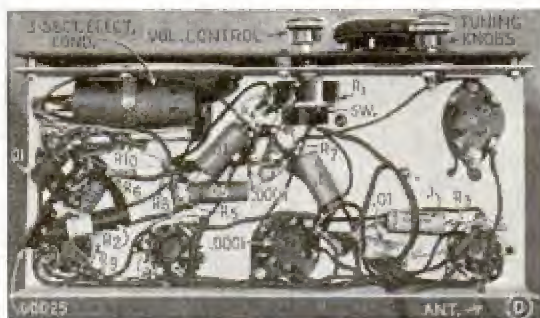
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with hub, and includes a 1-in. friction drive with shaft and knob. A detailed list of the original materials used in this set is available from Popular Mechanics radio department without charge. Please note that one of the insulated terminal strips is an upright type with two insulated lugs on a fiber strip. The other two strips are the ordinary type with two insulated terminals.

Set alignment is quite simple, as the I.F. transformer trimmers are already set in most cases to about the correct setting. Merely tune in a weak signal on the broadcast band and adjust each I.F. trimmer with a small insulated screwdriver, for maximum signal strength. If you are using the receiver on a d.c. line and no signal is heard, merely reverse the plug in the wall



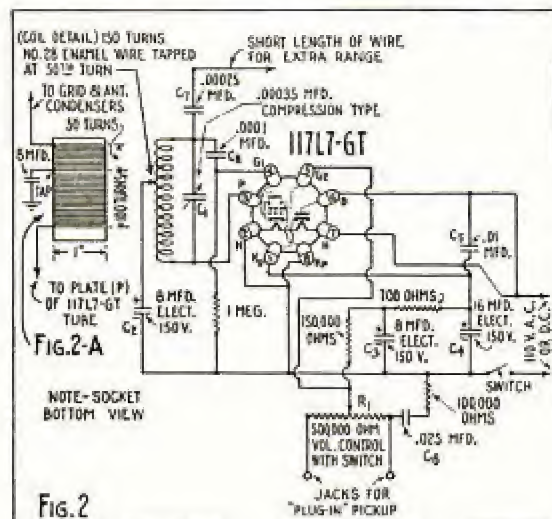
socket. To balance the set, tune the variable condenser to a minimum capacity; that is, with the condenser plates all the way out. Open the antenna coil trimmer on the rear variable condenser section (C_2) with a small screwdriver, about 1 to 1½ turns out from tight. Then open the oscillator trimmer on the front section (C_1) until police calls are heard. This will be about ½ to ¾ turns from tight. The oscillator padder condensers are adjustable for the broadcast band only, and will require a very slight adjustment, in fact scarcely any. Tune in a weak signal at about 600 kc. and make a slight adjustment of the padder, retune the dial with each adjustment to make certain that the signal strength increases each time. Continue to "rock" the variable condenser with each adjustment to be sure that the signal is at its maximum strength. No special precautions are necessary in wiring the set other than to make well soldered connections with rosin-core solder, keep all leads as short as possible, and follow the socket layout just as shown in Fig. 2. The blueprint number for this article is R-301.

"Wireless" Record Player

(Continued from page 158)

condensers and resistors rigidly. The smaller protruding portion of the chassis serves as a mounting for the 8-prong tube socket, and is attached to the larger strip of metal with the screws that mount the chassis assembly on the bottom of the box.

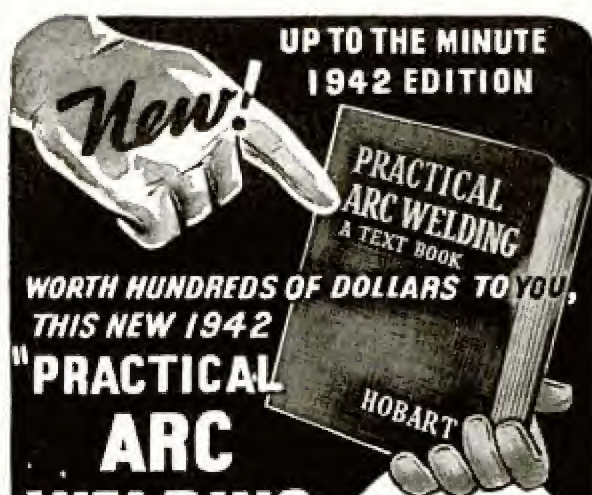
The oscillator coil is hand wound as in Fig. 2-A. The form can be a cardboard tube 1 in. in diameter and just long enough for



the single-layer clockwise-wound coil which can be tucked in under the tube socket. All wiring should be done on the metal chassis before it is bolted to the bottom of the box. A pair of phone-tip jacks are mounted in a corner of the motor panel for the plug-in pick-up. The pick-up swivel is mounted on a small strip of hard-pressed wood as shown in photo A; threaded phone tips are mounted on the opposite end and the pick-up connected to them.

Condensers C₅ and C₆ are 150-volt tubular paper types; C₇ and C₈ are mica types. The 700-ohm resistor is a 1-watt variety, all other fixed resistors are 1/2-watt types. One octal socket and a 500,000-ohm volume control with switch complete the list.

When operated near sensitive receivers, no external antenna is required, in most cases a short wire dropped on the floor will give best results. Set your receiver dial at any point between 1500 and 800 kc. where no station is heard. Plug in the player unit and adjust C_1 with a small screwdriver until a whistle is heard in the loudspeaker, then tune back and forth for maximum volume and best tone.



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Building the "Liberty" Fleet

(Continued from page 53)

yards to minimize possible bombing damage. Building the yards themselves has been a tremendous project, one California yard alone using enough timber piles to provide poles for a telegraph line from Chicago to Los Angeles.

A year ago the United States had practically no shipbuilders nor sailors to man them. As the pace increases more than half a million men will be working in the yards. More than 15,000 sailors and engineers will be needed for the new fleet. The task of training them has been taken over by the Maritime Service. Trainees must be 18 to 23 years of age, are paid \$72.50 a month while at a training station, and must agree to serve at least one year in the merchant marine after completing their course. They may study a selection of subjects that will fit them for special duties aboard ship.

During the last war the United States experimented with concrete ships, and the chances are the same construction will be used again. The plan calls for building reinforced concrete barges of up to 8,000 tons for transportation of bulk commodities. The barges would have no motors, but would be towed by tugs or ships.

If our capacity for building ships doesn't meet the demand, a number of wooden sailing ships may be built. On some trade wind routes the old time clippers often made fast passages that are rarely beaten by cargo ships today.

Also under consideration are two luxury liners larger than the "West Point," formerly the "America." These ships are designed for rapid conversion into aircraft carriers and for this reason would carry their stacks at one side of the hull. Instead of a single large engine room the propulsion machinery would be placed in two independent compartments to avoid a complete breakdown if the hull is pierced. It may be that because of the war the ships will be built as aircraft carriers for conversion later on into passenger ships, reversing the original plan.

Today the United States is being called upon to build ships faster than they are being sunk. A year ago it seemed that this would be impossible but now it appears that the impossible is going to be accomplished.



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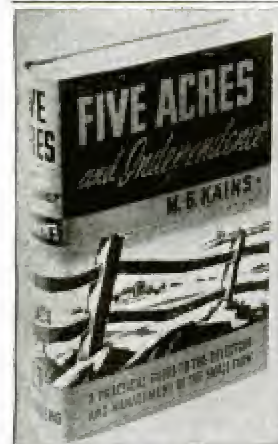
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Super Sailors for the Subs

(Continued from page 11)

Occasionally, however, a sailor will scream with fright, or tear off the mask and come to the top of the water gasping and choking. He simply could not stand the sensation of being cut off from the outer air. He might make a brilliant and daring aviator, but he will never qualify as an iron man for a steel fish. So it is back to general navy service for him.

In fact, the whole three months or more that a man spends in the submarine school is a test, for he is continually under observation by his instructors, who are usually veteran submarine sailors, and they are quick to spot any sign that a man is not fit for his responsibilities under the ocean's waves.

Is he flighty, or easily rattled? This is probably the final and capping test and it often comes when the candidate makes his first real dive in a submarine. Then he takes his post and handles routine orders. Perhaps he does well. Pandemonium will break loose, however, at the order of the commander. A diving order will be given. A fire alarm will also be sounded. Under each of these circumstances, every double-duty submarine sailor has one or more tasks to perform quickly and calmly. If the candidate does the wrong thing first, or the right thing too late or gets hopelessly confused, he's a marked man. He gets another chance, of course. But he will have to prove himself beyond doubt before Uncle Sam will trust him with the lives of his fellow crew members.

If he measures up physically and temperamentally, he has a number of basic lines between which he can choose—radio, sound operations, battery work, gyro operations or Diesel work—and he is sure to come out of the training competent in at least two specialties. As radio man he is likely to become also an expert in sound detection. As a battery man, learning to care for the 120 cells in each battery, each cell weighing nearly a ton, he may also be trained in gyro work and operation of the sub's controls. As Diesel man, working on the huge motors which drive a sub when it is on surface, he is sure to have another line in which he can double when the ship is below surface and the Diesels are shut off in favor of battery power.

To learn all of these things the classrooms include what is practically one or more large submarines taken apart and installed in the buildings. Huge Diesels are housed in a separate structure and there the sailors learn not only to run a Diesel almost as big as a cottage, but to take it apart and put it back together.

Substituting for the actual submarine for early training in manipulating the controls is a hooded platform which tilts up and down in response to submarine controls like a regular ship. While a petty officer gives quiet orders, the sailors are taught to submerge and resurface.

In another building which looks something like a florist's hothouse, are rows of great batteries and, like gardeners tending their plants, the future sub men pass along row by row watering and tending the cells. Even the intricate electric controls are transplanted into the building and here, as the orders are flashed in front of the novice he learns to trim ship and control speed.

A small number of lucky ones are given training in diving and this becomes one of their specialties when underwater repairs are needed on submarines.

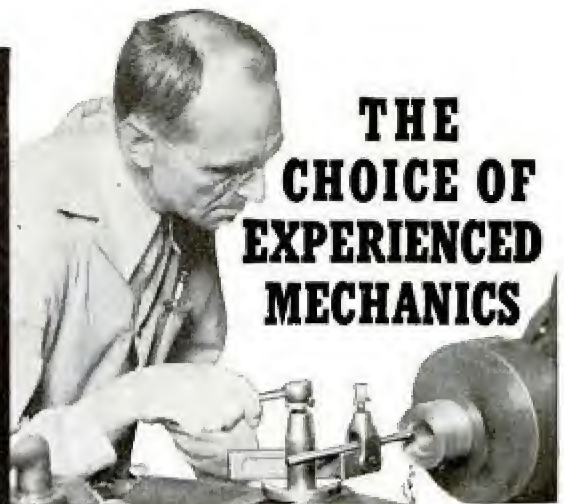
Thus before they set foot on a real submarine, the sailors become thoroughly familiar with every part of a submersible in the various rooms of the school.

Future Sources of Power

(Continued from page 5)

barrels of petroleum per ton. The potential supply is enough to supply our motor fuel for 100 to several hundred years, depending on the grade of shale considered acceptable. If the refinery cost of gasoline should double above its present figure of five to six cents per gallon, then shale oil might begin to compete, because mining or quarrying the shale, retorting it and disposing of the waste cost effort and money. Thus we have a considerable back log of motor fuel, but we would have to pay much higher price for it. Third, there is hydrogenation of coal as a source of oil. Germany and, to a certain extent, England are making fairly satisfactory liquid fuels by reacting hydrogen gas with low grade coal at high temperature and pressure in the presence of a catalyst. But the cost of pro-

(Continued to page 189)



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duction is about 20 cents a gallon compared to the American cost of five to six cents. We could drive our cars on motor fuel from coal, but we would have to pay dearly for it. Fourth, motor fuel might come from agricultural products, but this is not very practical because it is costly and because the supply would not be adequate. It would require nearly all the good crop land in this country to supply our motor fuel demand by this means.

In coal, we are the most happily situated country in the world. We have over half the known reserves, but less than six percent of the world's population. At present we have enough coal in sight (all grades) to last 3,000 years. That picture may change as the other 94 percent of the people of the world decide that we must divide up. Too, within the next 100 years many of the best deposits will be depleted and we will have to depend on lower grades. Expenses of recovery will go up, quality down. It will be wise to extend the life of our A-1 deposits as long as possible. Eventually, no matter how much we conserve, this sponging off past ages for fossil energy must cease—the deposits will have gone up in smoke. What then? That's a question which America will face eventually, which many groups of people in the world are facing right now.

The water power sources of the world are by no means fully developed, but even if they were, they would be quite inadequate. About 10 percent of America's energy comes from water power; full development might extend that to 20 or 25 percent. Wind power is undependable; only a small amount of power could be obtained by harnessing the tides and the waves.

About 50 times as much energy is stored up in plant life on the earth in one year as man utilizes in that year. It might appear that we could use the present growing trees, grasses and shrubs for fuel and thus solve our problem. Close investigation makes that idea discouraging. In the United States we would have to use nearly all our annual crop of vegetation (trees, grass, farm crops) to meet the energy demands. Nothing would be left to eat and the land would all be a desert in a few years. We can't push vegetation too far from its natural cycle.

Much has been said about obtaining
(Continued to page 190)



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great power by smashing atoms, but that seems a long way in the future. Radio-active materials, of which there are only minute amounts in the earth, disintegrate and slowly release large amounts of energy. If radium, for instance, were as plentiful as copper, atomic boilers using radium as fuel might be practical, but there just isn't very much radium available. One cannot say we will never be able to get energy from atomic disintegration, but we can't count on it—at least, for the present.

So we turn our faces hopefully to the sun, whence comes energy so plentiful that enough falls on about 200 square miles of an arid desert region to supply the whole United States with light, heat and power—if we can only find some way to utilize that energy efficiently.

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Flying Wings Are Coming

(Continued from page 15)

are hard to hold level in rough air. But such a wing has always been an intriguing goal. Any part of a plane that doesn't create lift is superfluous in theory.

Jack Northrop, among others, was irked by this inherent inefficiency of ordinary airplanes. His first experiment in 1929 had no fuselage, but it was not a true flying wing. An ordinary tail group was supported by two outriggers.

Northrop attacked the problem again three years ago, designing a true wing with the assistance of the research staff of California Institute of Technology. Models were put to months of wind-tunnel tests. Two synchronized motion-picture cameras correlated the wind tunnel data. One camera was trained on the model while the other recorded simultaneous readings of the tunnel instruments. Eventually a shape was evolved with the characteristics Northrop wanted, plus a control system that promised to make the wing as stable and maneuverable as a conventional airplane. The shape of the wing itself contributes to stability through all three axes. Both the wing and its control system have been patented. The control system consists of an arrangement of wing tip flaps.

After success in the wind tunnel the next step was to build a flying mock-up, one half or one third transport size, to see if it

(Continued to page 192)

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performed as well as the models. This wing is 28 feet from tip to tip, has considerable sweepback, and on its first flights was powered with two 60-horsepower engines later replaced by two air-cooled horizontally-opposed power plants of 120 horsepower each. The engines are completely buried in the wing and drive pusher-type propellers behind the trailing edge. Landing gear is retractable.

The first test flights were made more than a year ago and since then hundreds of others have been made. At first the wing tips were deflected downward at abrupt angles to provide instant response to the controls. Later the tips were rebuilt to study their characteristics at other angles. No matter what dip the tips have, they are permanent and not movable by the pilot.

Success of the wing and its control system was announced by Vance Breese and other test pilots who have flown it. They found the wing flies and handles just the same as a conventional airplane.

In addition to its greater aerodynamic efficiency the flying wing is lighter, cheaper, and easier to build than conventional aircraft of similar performance. Less noise enters the cabin. The greater efficiency of the wing permits carrying present loads at present speeds with much less power than is required at present, or it permits the same power to carry the same loads at much higher speeds.

Used as a passenger transport of the same capacity as present standard passenger carriers, the Northrop wing would be seven or eight feet thick. Crew, passengers, cargo, and motors would be entirely contained within the wing. A transparent leading edge as well as floor panels would permit passengers to watch the scenery. As a cargo transport, loading and unloading would be facilitated by large hatches on the upper surface of the wing. Since a few propellers are more efficient than a large number of propellers, it may be that for the huge flying wings of the future, a number of engines would be coupled to each propeller, possibly by means of an electric drive such as is used to propel some ocean-going ships.

In spite of the promise of the flying wing, engineers can't agree on what the airplane of the future will be like. Some doubt that the conventional tail group will be

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entirely eliminated. One compromise suggestion is the so-called "manta" design, virtually a flying wing but including a vestigial tail group about half the size of present tail surfaces. In the manta much of the lift of the true flying wing is retained while much of the ordinary tail and fuselage drag is eliminated.

Whatever the future holds, engineers agree that airplane design is now entering another cycle of refinement similar to the period that led to the development of the present cantilever monoplane.

The Emergency Patrol

(Continued from page 31)

rup pumps and sand available to extinguish incendiary bombs and to evacuate all pet dogs, which have a tendency to go mad under the excitement of a raid.

One novel suggestion for protection from air raiders was the proposal of A. F. Dickerson, head of General Electric's illuminating laboratories, for a canopy of light, rather than a blackout. Pointing out how headlight glare from automobiles renders the vehicles obscure, he suggested that thousands of small, powerful searchlights, pointed skyward, would blind enemy fliers and prevent them from spotting their targets. Similar groups of lights in fields near the city would confuse the bombers.

"Black light"—invisible ultraviolet rays focused on fluorescent surfaces—plays a big part in blackout schemes. Automobiles and buses, arm and hat bands and even warning signs glow with luminous paint at night, although invisible to aviators. Engineers found that street lights can be dimmed to a soft glow, making objects visible for 25 feet, yet furnish no light that can be observed from a bomber. This would also save current for war-time industry. Recommended for the blackout is a "black out sheet" of black paper which sticks to the inside of windows and bars escaping light. It also prevents glass from flying in the event of a nearby explosion. Another shutterlike sheet lets daylight in, but prevents light rays from escaping at night.

Power plants may be covered with huge "tortoise shells" of reinforced concrete to resist bombs. Mobile power transformers

(Continued to page 194)

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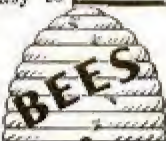
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Museums arranged to ship priceless objects to rural points. Such objects as the two-story dinosaur skeletons in the American Museum of Natural History will probably take their chances with bombs because of the difficulty of removing them.

An ingenious plan has been approved by which defense directors, using airplanes, navy blimps or vantage points atop the highest skyscrapers can direct the thousand or more radio-equipped police vehicles through the streets in an emergency. Cruising above the city in two airplanes, defense engineers testing the scheme were able to keep constantly spotted a black sedan with the word "TARGET" painted on its top, as the car moved in traffic below.

A dozen or more trailer fire pumps have been tested by the authorities. A typical unit will throw two two-and-one-half inch streams of water 75 feet high. These can be towed by hand over debris-strewn streets impassable to regular fire equipment.

Railroads are planning portable trestles by which traffic can be routed over and around bomb craters.

A suit with plastic-braced ribs which protects the firemen from the concussion of a bomb explosion has been invented. Front, back and shoulders have laminated plastic inserts and the fabric is noninflammable cotton gabardine. Also tested by defense experts is a 90 mile-an-hour motorcycle ambulance. It has a seven-foot sidecar to carry the patient and a medical attendant. A newly developed "alert" receiver turns on automatically when it catches an inaudible air raid signal from a broadcasting station, rings a bell to summon listeners and shuts itself off when the "all-clear" is sounded. The receiver can be fixed-tuned to any station. Plans have been considered for underground factories, buried under 80 to 100 feet of rock where defense work can continue under strafing.

Films from England are to be shown to New Yorkers demonstrating how to extinguish incendiary bombs. The favorite method is to drop a sand bag on the bomb, which usually smothers it in two minutes.

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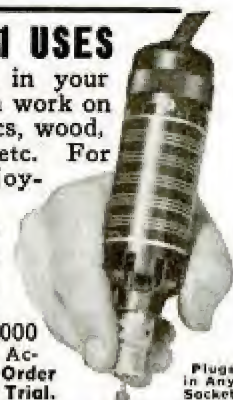
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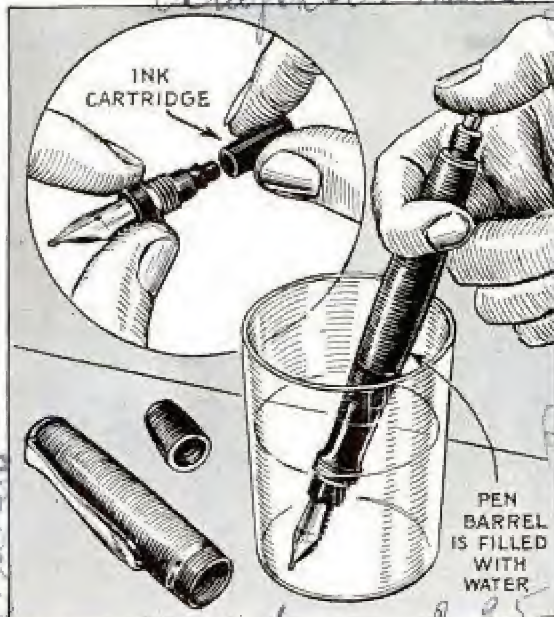
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Transmission of radio pictures in color and in three dimensions has been achieved by John L. Baird, English pioneer in television, as a result of applying principles of stereoscopy combined with complicated color processes. Still in the experimental stage, the present screen must be viewed from directly in front and can be seen by only one person at a time. However, the colored pictures have the qualities of depth which give viewers the illusion of seeing into an intensely real world. Pictures transmitted from a nearby studio included a bouquet of flowers and smoke curling upward from a pipe or cigarette. The inventor has now turned his efforts to developing the invention so the picture may be thrown on large theater screens.

MARCH, 1942

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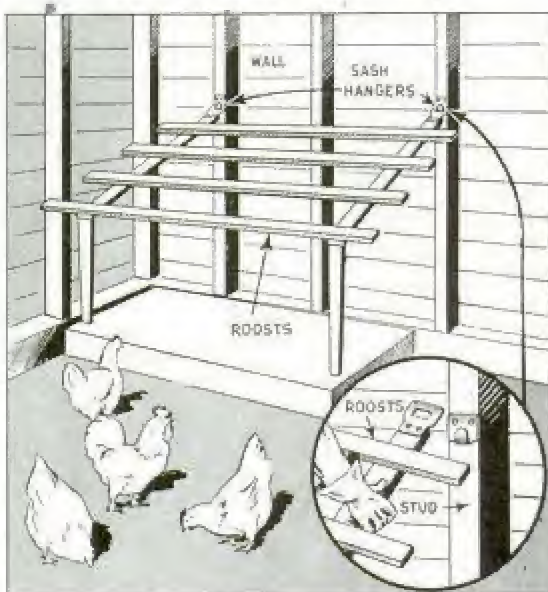
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Long-held theories that the camel's hump is a storage place for water have been disproved by recent investigations. Instead of being composed of cellular spaces for holding water, the hump is solid fat. Some water is "generated" from it, however, since the metabolism or burning of one pound of body fat gives rise to about a pound of water. The camel's normal reserve of liquid water is stored all over its body, as in other animals, and the camel can also store water in tissues under the skin. The water reserve in a camel depends considerably on the availability of salt. Deprived of salt, camels can actually become intoxicated when given pure water. The only recorded analysis of a camel's hump showed 80 pounds of fat. This would yield about 10 gallons of water when the fat was drawn from the hump as food.

☐ To learn where to buy commercial products described in these pages, see the index.

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LIGHT
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READ WHAT USERS SAY

Electrician says: "It is the best welding outfit." I wish to tell you that I demonstrated your welding outfit to a great many people, and they all agreed with me that it did the best welding job they ever saw. A. L. Bristol, Conn.

Mechanic Praises Welder. I have received my welder and like it very much. I am a mechanic and electrician by trade, so I can appreciate its usefulness to others. F. C. Perry, N. Y.

Repair Shop Owner Tells About Dynamic. I want to say I operate a repair garage and I am more than satisfied with the welder. It will do more than you say. C. P. Butler, Ohio.

Greatest Portable Outfit. I must say it's the greatest portable outfit any man could wish to own. You may put me on file as a booster. W. J. B., St. John, N. B., Canada.

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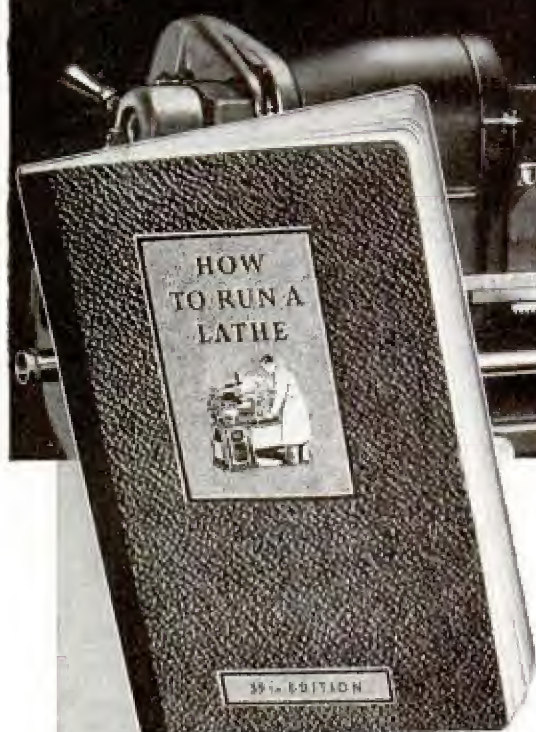
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TALK ABOUT your wood-gettin' wonder! You're looking right at him—"Low" Jackson of St. Louis, 1941 All-American, captain of the world's match game champions. Light up a slower-burning Camel and watch this champion of champions in action.

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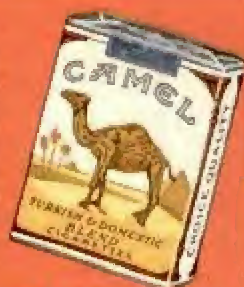
TWENTY TIMES "Low" Jackson (above) has rolled the perfect score. Every time he lights up a Camel he smokes with the assurance of modern laboratory science that in the smoke of milder, slower-burning Camels there is less nicotine (see below, left). Get Camels next time.

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